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should read the following :

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[No. 3.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Special Announcement.

Except for seasonal reports and Government Notices, this issue is devoted entirely to the publication of a memorandum dealing with the present position of the cattle industry in Southern Rhodesia.

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26	<i>Rivenhill Sibbeltje's Pride</i>	28/4/20	H. W. J. Blore
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26	<i>Aancang Oratie's Pride IV</i>	27/3/20	Frasers, Ltd.
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32	<i>Enid of Batavia</i> ...	1/3/16	A. A. Kingwill

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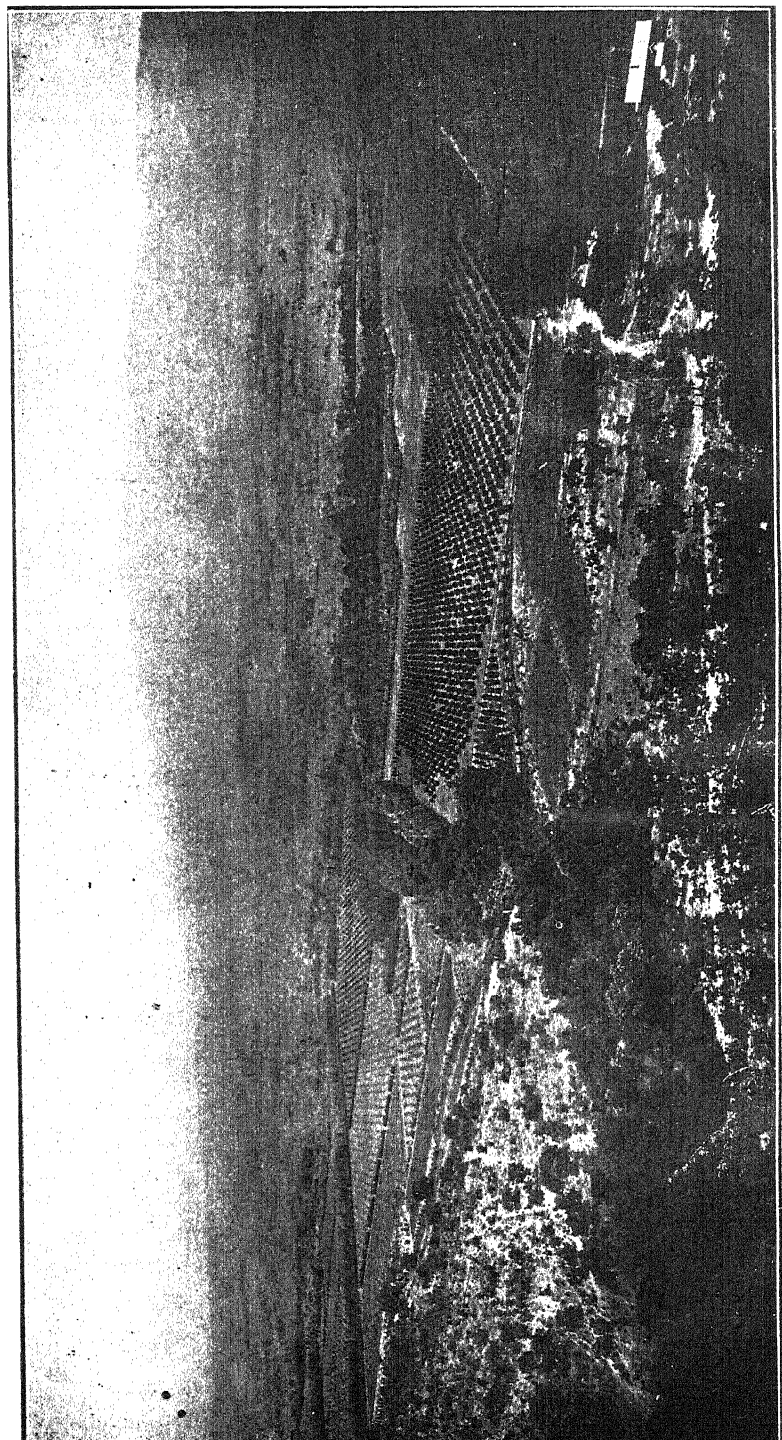
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Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—

The Editor, W. E. MEADE,
Department of Agriculture,
Salisbury.

Bulawayo Show.—The annual show of the Bulawayo Agricultural Society will be held on the 31st May and 1st June, and the usual sale of breeding stock will take place on 2nd June. A cup has been donated by the African Asbestos Mining Co., Ltd., Bulawayo, and the conditions of competition are as follows:—

- (a) The award is to be given to the best bull with four of his progeny. The bull is to be judged by his progeny exhibited.
- (b) The bull and his progeny must be registered or eligible for entry in any stud book.
- (c) The progeny need not necessarily be the property of the exhibitor at the time of the show.
- (d) The award will be given to the owner of the bull.
- (e) There is no limit to the age of the progeny.

(f) Entry forms must be completed and must state to whom the progeny belongs at the time of the show.

With regard to condition (a), after 1921 the number of the progeny will be increased to five.

The cup presented by Earl Buxton is being awarded to "the best dairy bull, to be judged on dairy points."

We learn that it has been determined to devote the fund in commemoration of the late Mr. E. A. Hull, collected by the Bulawayo Agricultural Society, to the erection of a hall in the showyard, to be known by his name and to occupy a prominent position in the semi-circular facade which is to form a handsome and conspicuous feature of the show ground. This decision will no doubt meet with very general approval by those who remember what an active interest the late Mr. Hull took in the advancement of agriculture and in the success of the Bulawayo show.

The Salisbury Agricultural Show.—It has been decided to hold the Salisbury Agricultural Show on Wednesday, 17th August, and the two succeeding days, thus conveniently preceding the Bulawayo autumn show and the fat stock show at Johannesburg. The most prominent feature this year is to be the sale of stud stock, especially of bulls, with a view especially of supplying the needs of Mashonaland farmers in this respect. As is already well known the Friesland Cattle Breeders' Association of South Africa have decided to extend their policy of advertising the breed, as they have done in the past at Bulawayo, by sending also to Salisbury a consignment of representative specimens, picked by competent judges, for exhibition and sale. Financial sacrifice is involved in this course, but it is undoubtedly a far-sighted policy, by which those interested in the breed as a whole will ultimately gain through extension of the region occupied by the black and whites and by accession to the numbers of its supporters. There is a strong possibility of the Hereford breed, and possibly others, being strongly represented in the selling classes by entries from the south.

Several noteworthy donations of cups have been offered, of which details will be made public when the allocation has been definitely decided upon. A farmer, interested in maize growing, is making anonymously an offer for the next three years, to add to the prize list of the Agricultural Society in one of the maize sections, namely, the section for 500 cobs Louisiana Hickory. There are usually three prizes awarded by the Society. The donor will add four more prizes of £4, £3, £2 and £1, so there will be seven prizes altogether. There will be no condition laid down as to the number of entries. If there are only seven entries, there will be seven prizes, including the three prizes of the Society.

Poultry Show at Bulawayo.—The Bulawayo and District Poultry Club, in conjunction with the Bulawayo Kennel Club, have arranged to hold a Young Bird Show at Bulawayo on the 26th February. This

is the first show of its kind ever held in Rhodesia, and we trust that poultry keepers will unite in making the show the success which the enterprise of the promoters merits. The schedule comprises 63 classes arranged under the following headings:—Egg producers, general purpose breeds, meat breed, fancy breeds, waterfowl and eggs.

It is interesting to note that a Rhodesian Poultry Championship Show has been arranged—the first of its kind—and this will be held in conjunction with the Agricultural Society Show at Bulawayo on the 31st May and 1st June next. Poultry keepers will also be interested to know that it is proposed to form a Rhodesian Poultry Association. Such an association would undoubtedly be of benefit to the industry, which we are pleased to see is making such rapid progress.

Union Markets for Rhodesian Cattle.—Arrangements have now been made to allow slaughter oxen consigned to the quarantine sections of the municipal abattoirs at Johannesburg and Germiston to be sold by public auction and re-trucked to the quarantine sections of Germiston, Johannesburg, Randfontein and Pretoria abattoirs. For the present no re-trucking of quarantine stock is permitted from the Pretoria and Randfontein abattoirs.

This extension of the markets in the south for our slaughter cattle is of material benefit to this country, and deserves to be made widely known. The fact that it is possible to re-consign to other markets must tend to stabilise prices and to minimise the financial disadvantage under which we have laboured hitherto, and so to enhance prices of Rhodesian cattle.

The opinion is held in this country that these quarantine regulations are quite unnecessary, and that our cattle might very well be admitted to the open market, as no animals are exported which would not be allowed free movement within the Territory. Further, the position in Rhodesia as regards diseases compares more than favourably with that in the Union, and it is only reasonable to expect the same facilities to the south as there are to the north.

However, we feel sure that cattle men in this Territory will feel gratified at this relaxation of the regulations, which it is to be hoped will be amplified in the near future.

Winter Cereal Crops.—We would draw attention to the Departmental Notice, appearing towards the end of this *Journal*, notifying the free issue of cereal seeds in limited quantities for experimental purposes. The issue is made with a view to further encouraging the growing of winter cereals both under irrigation and on moisture retaining soils. For those who desire information in regard to the growing of wheat under the conditions peculiar to this country we would refer them to the article which appeared in the December issue of this *Journal*, and which can now be obtained in bulletin form from this Department.

The possibilities of the vlei soils of this country for the growing of winter cereals were pointed out by the Chief Agriculturist in the article referred to, and it is no exaggeration to say that the whole of our requirements of wheat could be grown in these areas. At the present time, however, we are far from supplying our wants, for our imports of wheat, wheaten flour and meal for ten months of 1920 reached the huge amount of £97,850. We hope to see this figure reduced very considerably, and judging from the response which farmers are making to the efforts of the Department to increase the production of wheat, we are confident the returns will in the near future reflect a more satisfactory position.

It will be noted from the list of wheat varieties offered for distribution that several new kinds, never previously tried in Rhodesia, are this season being made available. These are varieties which have already gained great popularity in the Union. They are early or medium early maturing kinds, and in this respect resemble Early Gluyas, which may be regarded as the standard variety at present grown in Rhodesia.

In this connection a word of warning may be uttered. For many years now the Department has been issuing varieties of wheat for trial, while no doubt many farmers have imported new varieties on their own behalf; while it is essential that improved kinds should constantly be experimented with, it is equally essential that farmers should take the utmost care that the different sorts of wheat which they grow on their farms do not become mixed. At the present time we think we are right in saying that there is hardly any absolutely pure Rhodesian-grown wheat seed to be purchased in the country. This has come about through lack of care and want of selection. When we consider the wonderful success in growing pure seed achieved by our maize growers, there is no reason why Rhodesian wheat growers should not secure the same high reputation for their product. To do this, however, it is necessary that wheat growers should go through their crops when they are coming into ear, and should by selection separate the different types which occur. In most fields at least two or three different types will be found, and it should be the endeavour to segregate or to harvest separately at least small amounts of each of these and grow them separately next season. In this way it will be possible to ascertain which type is the best yielder, and at the same time to obtain pure strains of seed for use on the farm and for sale.

Mexican Marigold (*Tagetes minuta*, Linn).—We note with satisfaction the attention given at the last meeting of the Mashonaland Farmers' Association to the matter of the eradication of Mexican marigold, which is obtaining firm possession of old cultivated lands and ant heaps in various portions of the Territory.

While we do not think that under present conditions control by legislation is feasible, we do think that the matter calls for the widest publicity, and we therefore welcome the action taken by the Mashonaland Farmers' Association. The more the attention of farmers and others can be focussed on the importance of keeping Mexican marigold under

control the better. Concerted action is necessary, and, just as with the dipping of cattle, the weight of public opinion and the alertness to their own interests should be sufficient to cause all farmers to do their best annually to check the spread of this weed on their farms.

Reliance upon legislation to effect what self-interest cannot achieve is a dangerous policy, and weed legislation, even in countries much more densely occupied than is Rhodesia to-day, has been singularly unsuccessful. It is believed that a combination of effort on the part of farmers themselves and various public bodies, such as the railways and municipalities of the Territory, will, if vigorously applied, keep the weed in check. Such an effort was made last year, but we are afraid it was not applied in most cases until the weed had seeded, with the result that on many of the areas treated we find it more than ever in evidence. Seeding can be temporarily checked by mowing, but the only final means of eradication is by hoeing out or pulling by hand, while, where this is done in the case of ant heaps, the grazing may be improved by planting in its stead Kikuyu or couch grass. The thorough cultivation of land under crop, or the ploughing under of the weed before it seeds, will check its spread in arable lands.

The point is that the weed should be prevented from seeding, for not only are its seeds very numerous, but when ripe they are widely spread, being carried along rivers, drains, roads and cattle tracks, and apparently even to the summits of kopjes through the agency of live stock.

Signs of Progress.—With the opening of a new creamery at Bula-wayo and the approaching completion of a similar institution at Salisbury the dairy industry in Southern Rhodesia seems to be making rapid progress. As mentioned elsewhere in this issue, the value of butter exported from Rhodesia for ten months of 1920 amounted to £25,116, and it is confidently expected that this figure will be exceeded this year. It is very interesting to note that the cheese making industry is also making good progress; more cheese than ever is being manufactured this season, and the opening of a cheese factory by Mr. P. W. A. Shawe of Clanwilliam, Marandellas, will afford a lucrative outlet for the large quantities of milk which are produced in that district. The factory shows every indication of being a success, and Mr. Shawe's initiative and enterprise are to be highly commended. His example could well be followed in other parts of the Territory where difficulty is experienced in organising cream transport or in the disposal of butter.

Cotton.—Most of our readers who are interested in cotton will have seen the announcement in the daily Press advising growers not to plant cotton this season on account of the lateness of the rains. This information was disseminated by authority of the Department of Agriculture, and has generally been acted upon. A growing period of six months or more is needed for cotton, and it is therefore essential to plant

immediately after the early spring rains. These have been conspicuous by their absence this season, and in very few areas of the country did sufficient rain fall to permit of planting before mid-December. This, as indicated, is too late, for frost is frequently experienced in May and invariably in June.

It is unfortunate that there will be little or no data available this season, for our experiments have reached an interesting stage, and another year will help us considerably along the road of investigation. It is to be hoped that the weather conditions will be more propitious next season, and also that the slump which at present prevails in the cotton market will have passed.

“Cheap Sugar from Maize.”—The Trade Report of the National Bank of South Africa, Ltd., for October contained the following paragraph:—“A New York message states that, after more than three years of experiments, the General Food Products Company announces that Dr. Arthur W. Smith and S. P. Evans, of Baltimore, have invented a process by which white sugar may be obtained from maize and manufactured for less than 4 cents per lb. It is said that the sugar is 80 per cent. as sweet as cane sugar and should sell at 8 cents per lb. It is claimed that one bushel of maize will produce about 40 lbs. of the syrup, and that with an annual maize crop of more than three billion bushels, about 7 per cent. of the crop will produce all the sugar the United States can use.”

Apropos of the foregoing, it may be mentioned that a systematic enquiry into the sugar content of the juice of maize stalks was conducted by the Chemistry section of this Department some years ago. This enquiry was inspired by certain references which appeared in the American Press in regard to the profitable utilisation of the maize crop for the simultaneous production of sugar, alcohol and paper, as well as other minor products, such as maize oil. As a result of our local investigation and enquiries made in America, the conclusion was drawn that the references appearing in the Press gave an exaggerated estimate of the commercial prospects of such an undertaking. The economic possibility of manufacturing sugar, paper and alcohol from maize is not to be scouted. We cannot, however, accept the present bald statement as fact, and shall endeavour to obtain further information on the matter.

A Useful Native Plant.—The last issue of this *Journal* contained an editorial reference to *Pretrea zaquebarica*, I. Gay, a useful native plant known in Mashonaland as Loledza, in Manicaland as Dereri, and in Matabeleland as M'ginga-ginga. We described certain uses to which the emulsion prepared from this plant was put, and asked our readers to supplement this information if possible. In this connection we have received the following note from Mr. R. O. Ward of Headlands:—

“Re the plant ‘Loledza’ or ‘Dereri,’ another thing the mucilage made from it by steeping the leaves in water can be used for is the shifting

of 'rusted on' nuts of machinery, etc. If you cannot shift a nut take some of the mucilage and pour over the nut, leave for a minute and try the spanner again. Paraffin is a fool to it."

We have also been informed by Mrs. van Broemsen of Wick, Rusape, that the mucilage furnishes an excellent substitute for starch for collars, shirts, dresses and so on. We shall be pleased to receive any further information our readers can supply and to publish it in this *Journal*, for it is obvious that the plant possesses valuable properties.

Farmers' Associations.—We welcome the formation of farmers' associations at Gwanda and Hunyani. We wish these new associations every success, and trust that their meetings will be well attended and fully representative of the activities of the district.

We would take this opportunity of requesting secretaries of associations to notify the Editor of this *Journal* when the dates of their meetings are changed, in order that the information, which is published regularly, may be kept up to date.

Sunn Hemp (*Crotolaria juncea*).—The following note from Mr. C. Dimmock, Virginia, Lomagundi, regarding the value of Sunn hemp as a green manuring crop, is of interest:—" . . . It may interest you to know that the mealies I planted the first week in November on the half acre plot which had Sunn hemp on it last year are really extraordinarily good: thick stems, tall and good colour. I have never seen such mealies on this sand veld before."

The Oil Factory.—The Oil Factory at Salisbury, having been acquired by the Rhodesian Farmers' Co-op. Industries, Ltd., has resumed operations with the milling of ground nuts. The oil produced is of the refined and industrial types, the former of which is used as a salad dressing, and the latter for the manufacture of soap, which will probably be undertaken later on. Oilcake, the residue of the nuts after the oil has been expressed, will shortly be on sale, and it will no doubt find a ready market. It is hoped to treat cotton and sunflower seeds when the capacity of the plant has been extended.

An announcement may be expected shortly regarding the prices the Factory is prepared to pay for ground nuts and sunflower seeds. In this connection it is interesting to observe from the crop statistics published in this issue that the two oil crops, ground nuts and sunflowers, came next in acreage after maize, tobacco and wheat last year.

World's Poultry Congress.—Arrangements are sufficiently forward to make public the general arrangements for the first World's Poultry Congress, which, by invitation of the Netherlands Government, is to be

held at The Hague, Holland, from 6th to 13th September, 1921. That Government, through the Executive Committee formed by representatives of the Dutch Ministry of Agriculture and of the International Association of Poultry Instructors and Investigators, is generously providing for the Congress and various hospitalities to all who attend as delegates and members.

Congress committees have been formed in the following countries :— Belgium, Canada, Czecho-Slovakia, Denmark, France, Great Britain and Ireland, Italy, Norway, Portugal, Sweden and the United States of America.

A preliminary programme will shortly be issued giving details as to arrangements already made, list of papers to be read, and information for those who desire to participate in the Congress. Every provision will be made in respect to routes by which The Hague can be reached, special terms at hotels, etc. Those who attend will assuredly find much to instruct and interest in a country which has been described as the economic laboratory of Europe.

Papers have been promised by many of the leading authorities in the poultry world, by scientific investigators in various countries, by men of world-wide reputation as poultry instructors, by those engaged in what may be termed the commerce of the poultry industry, or who are engaged, officially or otherwise, in its promotion. Men and women whose names are everywhere known, notably those in America, have intimated their intention of being present.

Copies of preliminary programme and regulations for exhibition to be held at the same time can be obtained, when issued, from the secretaries of the various Congress committees, or from the General Secretary, World's Poultry Congress, The Hague, Holland.

All Government departments concerned in poultry work, public authorities and institutions engaged in poultry instruction or in research and experimental work, poultry and other societies and trading firms or societies may appoint delegates, and private individuals who may wish to become members may do so. A fee of £1, or 12 Dutch guilders, will be charged for each delegate or member, which will entitle them to all privileges of the Congress, inclusive of copy of the report.

The demonstration exhibition, it is anticipated, will include representative breeds of poultry from nearly all countries throughout the globe, displays by educational and scientific institutions, examples of appliances and apparatus used for production, education and commerce, models, books, bulletins, diagrams, photographs, food products, etc. This, it is anticipated, will be the most remarkable exhibition ever gathered together. Several Governments have intimated their intention of co-operating in it.

Statistics of Crops grown by Europeans in Southern Rhodesia

FOR THE SEASON 1919-1920.

By H. C. K. Fynn, Acting Statistician.

Introductory.—Statistics of production are of great importance and interest to the country at large, but to no one in the country are they of so much interest and importance as to the farmer. He is the producer, and it is the results of his activities that are registered in the annual statistics in such a way that he may see where progress is being made and where ground is being lost. The value of statistics is proportionate to their accuracy, and accuracy is impossible without complete figures. The completeness, and therefore the accuracy, and the value of statistics of production all depend upon the farmer and the farmer alone. The Agricultural Department may elaborate to perfection its system of collecting, tabulating and collating figures about the farming industry, but the labour and thought brought to this work will be wasted, or vitiated, unless all farmers co-operate with the Department. The admitted value of the statistics hitherto published is a proof that farmers as a whole do heartily co-operate, but it is desired to make farm statistics still more complete and reliable. To this end an appeal is here made to that small residue of farmers who are very slow to send back the forms delivered to them. Many excuses may be found for these men. Some do not keep any accounts or records; some find all kinds of writing burdensome after a day in the field; some merely delay and forget; and there may be some who do not know that it is obligatory upon them to fill up the statistical form and post it to the Department. There may even be a few who are suspicious that details about their private business may be put to improper uses, not realising that all statistical information supplied is under the seal of confidence, and that any officer revealing information about individual farmers is liable to a heavy penalty.

The farmers who do not realise that the return of statistics is compulsory, and those who for some reason object to make returns, are for the most part men new to the country, who do not know that it was the farmers themselves, in Congress, who requested the Government to pass a Statistical Ordinance, and that the statistical branch is simply carrying out the farmers' wishes. A further appeal is therefore made to the 99 good sheep that they may lend their help to teach the one in the wilder-

ness the wisdom of entering the fold. Not only is the work of the Agricultural Department hampered by the failure of a few farmers to make prompt returns, but the energy and goodwill of the 99 per cent. who make ready returns is also stultified.

Another matter in which the assistance of farmers is urgently requested is that they should inform the Department of every change of ownership, occupation or management of farms in their neighbourhood, so that no names be omitted from the list of farmers used by the Statistician in distributing his forms. The Statistician desires to acknowledge his indebtedness to the Police in many districts for their willing assistance generally, and particularly for obtaining and transmitting the addresses of farmers new to the country.

General.—A glance at the appended returns will be sufficient to reveal the fact that the crop yields during the past season constitute a record, the only exceptions being summer grown wheat, buckwheat, millets, teff grass and oathay. The total area under cultivation was 211,094 acres, compared with 205,439 acres for the previous season, a net increase of 5,655 acres, or 2.7 per cent. The climatic conditions in 1919-20 were on the whole ideal for the growing of almost every kind of crop. A few isolated cases are recorded where the maize crops on flat vleislands were a failure owing to abnormal rains. Early frost in some parts accounted for several failures in cotton and tobacco.

CEREALS.

The proportion of the acreage allotted to this class of crops (exclusive of maize for silage) to the total land under cultivation remains high, viz., 85.2 per cent. For the previous season the percentage was 87.2.

Maize.—The production of maize—the staple crop of this Territory—was 1,120,548 bags from 173,467 acres, an average of 6.45 bags per acre for the whole country. The total yield and the acre yield are records. The best previous crop was in 1916-17, when the yield was 938,130 bags. The acreage under maize, inclusive of 4,955 acres allotted to silage maize, brings the total acreage under maize to 178,422 acres, equal to 84.5 per cent. of all land cultivated. The bulk of this crop was produced in the following districts in order of production, viz.:—Mazoe, 557,254 bags; Salisbury, 197,372 bags; Lomagundi, 99,423 bags; Hartley, 68,711 bags; and Gwelo, 45,502 bags; equal to 86.4 per cent. of the total maize yield. It will be observed that the Lomagundi production now takes third place and the Hartley fourth, whereas in the previous season the order was reversed. The increase in the area under maize, compared with 1918-19, was 154 acres, or .08 per cent.

This satisfactory yield may be attributed to several causes: (1) favourable climatic conditions, (2) the abandonment of old lands, (3) larger and more up-to-date stocks of cultivating appliances held by merchants than hitherto, resulting in increased and more thorough cultivation, and (4) the selection of high grade seed by the majority of farmers.

PRODUCTION OF MAIZE, 1915-16 TO 1919-20.

Season.	Acres.	Bags.	Yield per acre.
1915-16	174,647	680,285	3.88
1916-17	203,150	938,130	4.62
1917-18	192,148	591,722	3.08
1918-19	173,313	889,969	5.13
1919-20	173,467	1,120,548	6.45

Wheat.—Winter grown wheat shows a marked improvement, the increase in acreage being 1,101 acres, and the average yield per acre 3.4 bags. Of the 15,237 bags harvested, 8,780 were produced in the following districts in order of production, viz.:—Charter, 3,220 bags; Chilimanzi, 2,776 bags; Melsester, 1,725 bags; and Hartley, 1,059 bags.

Wheat ranks next in area after maize and tobacco. The acreage and yield returned for summer grown wheat show a decline in popularity. The decrease in acreage, compared with the previous season, was 356 acres. The yield per acre was the same, viz., 2.7 bags.

PRODUCTION OF WHEAT, 1914-15 TO 1919-20.

Season.	Summer.		Winter.		Totals.	
	acres.	bags.	acres.	bags.	acres.	yield.
1914-15	320	750	1,364	5,489	1,684	6.239
1915-16	866	2,397	801	3,559	1,667	5.956
1916-17	1,534	3,031	3,121	12,394*	4,655	15.425
1917-18	1,265	2,541	3,755	11,265*	5,020	13.806
1918-19	1,041	2,938	3,353	10,494*	4,394	13.432
1919-20	685	1,905	4,454	15,237*	5,139	17.142

*Estimated.

Kaffir Corn.—Only 490 acres were allotted to this crop during the past season, of which 358 acres were returned by Matabeleland. The value of this grain as a dry land crop and the suitability of the stalks for silage purposes are not sufficiently realised. Compared with maize, its production is more certain, and it is a noted drought resister.

Oats.—The acreage returned under oats was 1,402, of which 1,119 formed the winter crop. For the previous year the total acreage was 1,485. Greater attention could profitably be bestowed on this crop with the object of augmenting the supply of locally grown feed oats for poultry, for which there is a steadily increasing demand.

SUCCULENT AND ROOT CROPS.

Potatoes.—This crop shows a slight increase in acreage and a substantial increase in acre yield for the summer crop. The winter crop shows an advance in acreage only, the acre yield being slightly below that for 1919.

Pumpkins, although given a smaller acreage, yielded more than double the quantity shown in 1918-19, or 122.4 per cent.

Cattle Melons also occupied less ground, but show an increased yield of 96.8 per cent.

The acreage devoted to **Sweet Potatoes** rose from 499 in 1919 to 1,115, yielding 10,360 bags, or 9.2 bags per acre.

FODDERS.

The acreage under fodders shows an appreciable increase all round, with the exception of lucerne, barley and teff grass; the latter appears to be declining in popularity.

GROUND NUTS.

Ground nuts advanced in acreage from 1,706 in 1919 to 2,430, and in yield from 10,589 bags (6.2 bags per acre) in 1919 to 16,574, or 6.8 bags per acre in 1920.

TOBACCO.

The total yield of tobacco for the season under review was, for Virginian 2,415,607 lbs. from 5,546 acres, and for Turkish 511,633 lbs. from 1,958 acres. The average yields per acre were 435.5 lbs. and 266.4 lbs. respectively, compared with 369 lbs. and 288 lbs. in 1919. A few growers reported the loss of tobacco in the process of curing, from mildew, due to unavoidable causes. The following table gives particulars of tobacco grown in the Territory.

PRODUCTION OF TOBACCO.

Season.	Acres.			Yield.		
	Vir- ginian.	Turkish.	Total acres.	Virginian.	Turkish.	Total yield.
				lbs.	lbs.	lbs.
1915-16 ...	...	...	1,310	...	...	637,261
1916-17 ...	...	...	1,995	...	...	910,684
1917-18 ...	2,434	813	3,247	415,210	204,961	620,171
1918-19 ...	3,198	999	4,197	1,179,932	287,680	1,467,612
1919-20 ...	5,546	1,958	7,504	2,415,607	511,633	2,927,240

FIBRES.

The only fibre crops grown were Sunn hemp 40 acres, and Hibiscus 13 acres.

OTHER CROPS.

Beans show a smaller acreage for the year, but an increased yield. The same remark applies to buckwheat. Rice figured for the first time in the returns with an acreage of 93 acres and a yield of 318 bags, or 3.4 bags per acre. Rapoko occupied 232 acres, and yielded 590 bags, or

2.5 bags per acre. Sunflowers, with 1,826 acres, show a considerable advance in acreage and in yield, the acre yield averaging 6.7 bags compared with 3.6 in 1919.

Besides the crops enumerated in the main return a variety of minor crops occupied 305 acres. The majority of these were in the nature of experiments, and do not warrant any comment here. The following table sets forth the most important of these crops:—

DETAILS OF SUNDRY CROPS.

	Crop.	Acres.	Total.
Cereals, legumes, etc.	Munga	10	
	Peas	64	
	Kaffir beans	40	
	Rape	2	
	Winter mealies	6	
	Unspecified	1	
		—	123
Succulent and root crops	Field radish	1	
	Swedes	3	
	Chicory	2	
	Turnips	1	
	Water melons	3	
		—	10
Fodders	Paspalum	42	
	Kikuyu grass	21	
	Molasses grass	2	
	Sundry grasses	10	
	Umfufu	2	
	Sudan grass	4	
		—	81
Various	Broom corn	25	
	Linseed	13	
	Sunn hemp	40	
	Hibiscus fibre	13	
		—	91
			305

CITRUS ORCHARDS.

The following summary shows the kinds and numbers of citrus trees in existing orchards:—

	Trees bearing.	Not bearing.	Total.
Oranges	52,825	93,117	145,942
Lemons	9,265	14,216	23,481
Limes	371	214	585
Naartjes	4,427	1,121	5,548
Grape fruit	1,706	1,846	3,552
Pampelmoes	239	169	408
	68,833	110,683	179,516

TABLE I.
Districts in order of Acreage of Cultivated Land.

District.	1919-20.		1918-19.		1917-18.		1916-17.	
	Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.
Mazoe ...	67,781	1	64,279	1	58,839	1	57,622	1
Salisbury ...	34,079	2	33,166	2	41,622	2	45,939	2
Lomagundi ...	17,938	3	15,533	4	18,096	4	17,392	4
Hartley ...	17,691	4	17,489	3	23,876	3	25,171	3
Gwelo ...	15,777	5	15,525	5	16,274	5	17,072	5
Marandellas ...	5,912	6	5,670	7	7,538	7	8,342	8
Makoni ...	5,409	7	5,614	8	8,163	6	9,557	6
Victoria ...	5,095	8	4,154	9	5,225	11	4,362	15
Insiza ...	5,018	9	5,904	6	5,785	8	8,584	7
Bubi ...	3,991	10	3,815	14	3,524	14	5,072	12
Bulalima- Mangwe ...	3,579	11	3,281	15	5,627	9	6,776	9
Charter ...	3,571	12	4,094	10	4,552	13	5,967	10
Nyamaudhlovu ...	3,225	13	3,500	12	3,115	16	4,644	14
Umtali ...	3,093	14	3,074	16	4,728	12	5,093	11
Bulawayo ...	2,948	15	3,438	13	3,469	15	3,921	16
Chilimanzi ...	2,906	16	3,942	11	5,312	10	4,885	13
Melsetter ...	2,307	17	2,006	18	2,410	18	2,833	18
Matobo ...	1,586	18	2,129	17	2,652	17	3,246	17
Gutu ...	1,525	19	1,180	22	1,151	22	1,505	22
Ndanga ...	1,363	20	1,559	19	1,056	23	1,055	24
Mrewa ...	1,200	21	1,211	21	1,233	20	2,127	20
Selukwe ...	1,017	22	1,376	20	1,212	21	2,722	19
Wankie ...	837	23	1,081	23	1,376	19	1,150	23
Umzingwane ...	825	24	951	24	978	24	1,821	21
Darwin ...	686	25	590	26	492	26	399	28
Gwanda ...	651	26	653	25	762	25	694	25
Inyanga ...	593	27	183	28	335	28	529	26
Belingwe ...	399	28	424	27	434	27	516	27
Mtoko ...	61	29	98	29	92	29	34	29
Chibi ...	31	30	20	30	25	30	10	30
	211,094	...	205,439	...	229,953	...	249,038	...

TABLE II.

Cultivated Crops in order of area in 1919-20.

Crop.	Acres.	Acre-yield.				
		1920.	1919.	1918.	1917.	1916.
Maize (grain) ...	173,467	6.45 bags	5.13	3.08	4.62	3.88
Tobacco ...	7,504	390 lbs.	350	179	456	486
Wheat ...	5,139	3.33 bags*	3.0*	2.0†	2.0†	2.9*
Maize (silage) ...	4,955	3.17 tons	2.3	2.2	2.0	...
Ground nuts ...	2,430	6.8 bags	6.2	2.8	6.3	7.36
Sunflower ...	1,826	6.7 bags	3.6	2.2	3.3	5.6
Potatoes ...	1,823	23.4 bags*	21.7*	12.4†	14.0†	20.4*
Pumpkins ...	1,801	5.4 tons	1.9	2.5	2.18	...
Beans ...	1,789	2.04 bags	1.4	1.0	1.9	1.4
Cattle melons ...	1,698	5.7 tons	2.6	1.0	3.67	...
Oats ...	1,402	...	...	...	...	...
Sweet potatoes ...	1,115	9.2 bags	...	...	...	...
Napier fodder ...	1,012	...	...	...	...	...
Teff grass ...	968	...	...	...	...	...
Cotton ...	711	...	...	...	...	...
Velvet beans ...	581	...	...	...	...	...
Kaffir corn ...	490	3.5 bags	1.9	1.0	1.8	1.8
Cowpeas ...	458	...	...	...	...	...
Sundry crops ...	305	...	...	...	...	...
Buckwheat ...	283	2.8 bags	1.7	1.7	2.6	1.6
Barley ...	278	...	...	...	...	...
Milletts ...	277	...	...	...	...	...
Rapoko ...	232	2.5 bags	...	...	...	...
Rye ...	194	...	...	...	...	...
Lucerne ...	116	...	...	...	...	...
Rice ...	93	...	...	...	...	...
Onions ...	86	...	...	...	...	...
Dhal ...	42	...	...	...	...	...
Linseed ...	13	2.2 bags	...	...	...	...
Mangels ...	6	...	...	...	...	...
211,094						

* Summer and winter crops.

† Summer crop only.

TABLE III.
Acreage in relation to Class of Crop.

Class.	Crop.	Acres.	Total acres.
GRAIN	Maize ...	173,467	179,898
	Wheat ...	5,139	
	Kaffir corn ...	490	
	Buckwheat ...	283	
	Rapoko ...	232	
	Rye ...	194	
	Rice ...	93	
SUCCULENT AND ROOT CROPS	Maize (silage) ...	4,955	11,411
	Potatoes ...	1,823	
	Pumpkins ...	1,801	
	Cattle melons ...	1,698	
	Sweet potatoes ...	1,115	
	Sundry ...	19	
LEGUMES	Ground nuts ...	2,430	5,374
	Beans ...	1,789	
	Velvet beans ...	581	
	Cow peas ...	458	
	Lucerne ...	116	
FODDERS	Oathay ...	1,402	4,018
	Napier fodder... ..	1,012	
	Teff grass ...	968	
	Barley ...	278	
	Milletts ...	277	
	Sundry ...	81	
VARIOUS	Tobacco ...	7,504	10,393
	Sunflower ...	1,826	
	Cotton ...	711	
	Onions ...	86	
	Sundry ...	266	
			211,094

From Breeder to Butcher.

CATTLE FEEDING EXPERIMENT No. 8.
GOVERNMENT EXPERIMENT FARM, GWEBI.

By ERIC A. NOBBS, Ph.D., B.Sc.

During several past seasons a series of experiments have been in progress with the object of determining the best methods of fattening cattle, and of adapting to our conditions the generally recognised principles of the process. In this way a system of fattening cattle has been arrived at appropriate to our seasons and circumstances, and suitable to the class of cattle we possess, utilising nothing but crops grown on the farm, with due regard to economy and profit. Incidentally it was desired to show in detail every charge connected with the transmission of fat stock to Johannesburg and to ascertain the wastage of the animal which takes place under the present system of live transport. The results of past experiments had so cleared the way that it was possible to conduct this experiment on a sufficiently large scale to reduce the effect of individual idiosyncrasies and to get average figures which are likely to be near to usual practice and experience. It had been the intention to send the meat from Johannesburg, in frozen condition, *via* Durban to London, but unfortunately the necessary facilities for freezing could not yet be provided in Johannesburg, the weak link in an otherwise complete chain. To have sent the animals alive beyond Johannesburg to freezing works nearer the coast was impracticable, both on grounds of cost and of the effects of the long journey already upon them. Assurances were given that next year it would be possible to kill and freeze at Johannesburg, and so for Rhodesian beef to reach the markets of the world, but it must be admitted that the long journey to Johannesburg from Bulawayo and beyond is very much against this becoming a general or commendable practice. The cruelty involved, the relatively high cost of live transport, the loss of weight, and in respect of the condition of the meat, the damage by bruising during the journey, all combine to condemn the idea.

Past Experience.—Before entering upon a description of these experiments, it may be helpful to review briefly the lessons learnt in previous years at the Government experiment farm, Gwebi, in regard to fattening cattle.

(1) Artificial fattening is only to be undertaken between June and January, or in certain seasons and as extreme limits from May to February.

(2) The more quickly the animals are fattened the better. The duration of the fattening process should not exceed five months, and as much less than this as can be managed.

(3) To this end feeding with concentrates is essential, but all the food may be grown on the farm.

(4) It is not profitable to stall-feed cattle whilst the veld is abundant; it is better to let the stock graze till about May.

(5) Complete stalling is preferable to grazing by day and stall-feeding by night.

(6) It is not profitable to fatten artificially the unimproved cattle of the country nor old and worn out trek oxen; only grade stock are worth feeding, and the higher graded they are the more profitable does the process appear to be.

(7) It only pays at present to convert the cheaper forms of fodder and cheaper grades of grain into beef, as the finished article has to compete with veld fed meat, and the markets are not highly discriminating. Such comparatively costly products as cake and linseed are therefore to be avoided, and others, such as beans, ground nuts and mangels, used as sparingly as is consistent with securing a properly balanced ration.

Cattle Employed.—Forty cattle were chosen from a mob of 60 selected by Mr. H. C. Michell, Manager of the Rhodes Inyanga Ranch, as typical mature grade stock in good store condition straight off the veld. They consisted of grade Shorthorn oxen, calved in 1915-16, out of high class cows of mixed breeding, and had been reared under ranching conditions, never kraaled at night, and quite unaccustomed to handling. They varied at the outset in live weight from 900 lbs. to 1,240 lbs., averaging 1,023 lbs. The actual weight of each ox is given in Table II. They were thus well-grown, thriving oxen of nice quality, a sound type of commercial cattle such as is now becoming more common than formerly, if not exactly general as yet. As cattle from a distance would experience a set back simply from the change of veld, and would, as was known from past trial, again experience a check on being put on to artificial food, it was considered advisable to put them at once into the kraals and so have only one instead of two changes. The cattle came therefore straight from the Inyanga mountains, 60 miles by road and 130 miles by rail, into the feeding pens on the Government experiment farm.

Course of the Experiment.—At the date of arrival the veld was rapidly going off. At first the stock were, as is always the case, restless, and only gradually took to their food. Some adjustment in the pens was necessary, so that the weaker should not be bullied. However, apart from the loss in weight registered the first week, and which is only to be expected, the stock soon adapted themselves to their new surroundings and new mode of life, and no difficulty was experienced. The accompanying photograph shows the very simple accommodation provided, merely enclosures, about 21 feet by 33 feet, made of gum poles grown on the farm, and lean-to roofs giving shelter and shade. Bedding was put in as required. Eight head, arranged according to size, were put

in each pen, and had to be let out pen by pen to drink at a trough twice a day, as water was not, as it should be, constantly available within the pen or court.

As a general guide a standard of feeding, based on experience gained in past experiments, was arranged beforehand and adhered to within limits, though actually some discretion was used as to the employment of available foodstuffs and change as and when circumstances demanded. Three periods were provided for of 50, 50 and 40 days, or twenty weeks in all, but a shorter time was to be taken if possible. The first period, in view of the set-backs experienced in the first and third weeks, was extended to eight in place of seven weeks; the second period, as the stock were doing well and giving indications of maturity, was correspondingly reduced by a week. During the final stages hot weather set in, and as the cattle looked quite prime, and, moreover, as the market authorities advised that to send all down together would, with the ordinary supplies from other sources, glut the market for beef of this quality, it was decided, at the end of the seventeenth week, to stop the experiment so far as feeding was concerned, sending away the stock in three consignments at intervals of a week, so that the last lot were nineteen weeks in the courts. The ration, based on the weekly live weight, was changed for each period, and modified from time to time according to the appearance of the cattle.

Consumption of Food.—The average weight of food consumed each day per head was 57 lbs., made up approximately of 25 lbs. of hay, 12 lbs. of grains, and the rest, 20 lbs., of silage, majordas or other succulents. But the feeding of the stock is not such a simple matter as might be imagined from the above average figures. The amount, character and proportions of each of the fifteen different ingredients were carefully taken into account on a scientific basis, backed by the results of several previous years of experimenting. The actual rations were given per 1,000 lbs. live weight, not merely per head, and with a nice regard for the correct apportionment of starch, fat, proteids and ballast, as well as for the stage of condition reached, and the hunger or fastidiousness of the animals under observation.

In Table I. are shown the quantities of various foodstuffs actually consumed in all and in each period to maintain life and produce the total increase of live weight recorded, viz., 10,705 lbs. These may be conveniently grouped in three categories as hay, concentrates and succulents. The veld hay was good sound natural grass, and the words "artificial hay" have been used to distinguish from it the teff, Sudan grass and other such hay crops which are also grown on the experiment farm. Velvet bean hay is of course a rich albuminoid diet, whilst the pea and sunflower chaff consisted of the winnowings from threshings of these crops, and contained a certain amount of light seeds and husks, which were advantageously consumed by the cattle. Of hays, as indeed with all available classes of farm foods, occasional change is most desirable; indeed, whilst keeping the diet as simple as possible, some variety has a most stimulating effect, and is to be recommended, provided no sudden and complete change is attempted. Maize is the foundation of the diet, but for fattening stock it is not necessary to use export grades;

inferior grain, if sound and wholesome, is quite as suitable, and if desired, corn and cob can be crushed together, thus saving the labour of shelling; but if this is done, it is to be fed at the rate of the grain contained only. Maize in Rhodesia replaces the cake used in Europe, and with the accompanying concentrates, such as bean meal, ground nut or sunflower meal or the like, is an excellent substitute; coming off the farm, it escapes dealers' and manufacturers' profits. In all, slightly over 5½ bags of maize per beast were used, as compared to nearly 6 bags per head last year. The bean meal was derived from different sources, but dhal has been found as useful and economical as any other. Sunflower and ground nut meal is valuable as a source of oil, and was used at first to induce the animals to eat from the troughs and latterly to stimulate their jaded appetites. Of succulent food, silage is the mainstay, yet some difficulty is often experienced in inducing the animals to acquire the taste, and again towards the later stages they are apt to lose their zest for it, hence it is very desirable to maintain appetite by providing other juicy foods also. In this connection field radish again proved excellent, but it has to be used early in the season, as it is not a good keeper. Majorda was a light crop last year on the farm, so had soon to give place to pumpkins, which have a higher feeding value, and these in turn were followed by mangold wurzel, which, from its consistent success at the Gwebi, deserves, under similar conditions, to be more largely grown than is to-day the case. A supply of sweet potato tops being available, these were utilised as a welcome variant to the ration.

Value of Food Consumed.—On the basis of thirty-nine head, the cattle in the courts consumed over 58 tons of hay, or 3,000 lbs. apiece; nearly 220 bags of maize and 60 bags of other grain, or over seven bags of grain each, together with over 46 tons of succulents, of which nearly 20 tons was silage. The total weight of food used was 133 tons, or 3½ tons per head. If for these commodities top market prices were taken a great error would be made. The food in its natural bulky condition never leaves the farm. The saving in transport of all this weight is not inconsiderable. With the help of a small amount of grain which might have been marketed, a large quantity of other produce, which could not be sold, is converted into a concentrated portable and readily saleable article—meat. Even the grain, however, may be of unmarketable grade; good sound offal grain is quite suitable for this purpose.

By the arbitrary adoption of prices for unmarketable products, which may yet be advantageously grown on the farm, it would be possible to show either a profit or a loss on the fattening of cattle by this method. Each farmer must calculate for himself if it would pay him under his conditions, or if another course is more profitable, and in doing so must take many factors into consideration, such as possible markets for alternatives, grain, baled hay, pumpkins or dairy products derived from his crops and pasture. He must consider also the advantages of growing crops suitable for feeding to oxen, and the benefit of so using his cattle instead of selling them off the grass; these and other considerations must weigh with the individual on deciding the question.

It is to be emphasised that all these crops were grown on the farm.

On the farm as harvested they are mainly unsaleable, but ought to be grown in all rotations for the sake of staple crops and in order to increase the yield of the maize or other market crops produced, and maintain the fertility of the soil. In feeding they are at once converted into a most necessary concentrated and valuable product readily saleable, whilst the production of about two tons of first rate manure per head is an element not to be despised.

In Table I. is also shown the weights of food actually used to produce a gain of one pound live weight in this experiment and in a similar one carried out last year. The comparison is interesting, for it shows that the final weights were attained this year at a less total weight of food, one-sixth less being used. The figure was 24.78:1 as against 29.73:1 in 1919. Of hay the difference is over two pounds and of succulents over 4 pounds; but rather more concentrated food was given, 5.2 as against 5.03 pounds, and amongst these are found the more costly forms of diet. Actually somewhat less maize was needed and about the same quantities of bean meal and sunflower meal, but the extra half pound of crushed ground nuts throws the balance the other way. The ground nuts, it may be mentioned, were crushed along with the maize, which absorbed any free oil, making the grinding easy and the food very attractive to the cattle, whilst the nuts, replacing the starch of maize, also raised the nitrogenous ratio. The greater variety of diet, yet all within the power of almost any farmer to provide with ease, is probably the main reason for an improvement in the results of this year's experiments, compared with previous trials.

Rations.—Based on previous experience, the daily ration per 1,000 lbs. live weight for the first or feeding period was intended to consist of 8 lbs. of maize, 16 lbs. of hay, 16 lbs. of silage and 8 lbs. of field radish. Actually it was as follows:—

Maize	7.75 lbs.
Veld hay	11.25 lbs.
Artificial hay or velvet bean hay	4.25 lbs.
Sweet potato tops or silage	12.5 lbs.
Field radish, majorda or pumpkin	9.1 lbs.
Pea waste (two weeks only)	3.1 lbs.
Sunflower waste (two weeks only)	3.1 lbs.

Considerable difficulty is experienced in inducing stock fresh off the veld to feed in kraals or courts, which explains the complications of what was really a simple diet of hay silage, mealies and majordas. Thus at first silage was refused, hence sweet potato tops were used for the first two weeks, after which silage was taken in steadily increasing quantities. Similarly the artificial hay and waste from sunflower and peas blown out in winnowing the seed were given for the first fortnight as dainties to induce the cattle to feed. During the first week under this treatment a slight but perceptible loss in condition was noted in sixteen out of the forty head; in the aggregate there was a loss of 27 lbs., so that virtually there was no change. Thereafter there was a consistent rise each week except for the very remarkable loss in weight in every pen and in every

individual except two during the third week. This may be attributed to the change to a simpler diet by knocking off the sweet potato tops and pea and sunflower waste and substituting silage. Certainly no other reason is apparent. This emphasises the need of a gradual change in diet even from one but recently established.

At the end of the first period a change was brought about by the introduction in the seventh week of velvet bean hay, 5 lbs. per 1,000 lbs. live weight, and in the eighth week artificial hay and bean meal at the rate of one pound each. Field radish, a good cropper and good feeder, but not a good keeper, was used until the supply was finished, when pumpkin was substituted. Majorda was a poor crop last year, and the amount used was insignificant, otherwise that would have been given after the field radish was finished. The standard ration for this period, subject to the above aberrations, consisted of 8 lbs. of maize, 16 of silage, 16 of veld hay and 8 of field radish or pumpkin per 1,000 lbs. live weight, which at first virtually also meant per beast, since that was approximately their weight (actual average 1,023 lbs.).

During the second or fattening period the basis of the daily ration, calculated always per 1,000 lbs. live weight, was as follows:—7 lbs. of maize meal, 1 lb. of ground nut and 1 lb. of bean meal, with 14 lbs. of veld hay, 10 lbs. of velvet bean hay, 14 lbs. of silage and 8 lbs. of mangolds or pumpkin. The actual diet consisted of the following:—

Maize meal	10 lbs.
Veld hay	8.75 lbs.
Silage	8.25 lbs.
Velvet bean hay	15.5 lbs.
Mangolds	9.75 lbs.
Bean meal	1.25 lbs.
Ground nut meal	1.25 lbs.

Steady progress was made on this somewhat richer, though by no means extravagant diet.

In the eleventh week it is to be observed that in certain pens the increase was low, and in four animals an actual loss of weight was observed. At this time and on account of the cattle ceasing to relish it, the silage ration was stopped and the velvet bean hay in lieu thereof was raised to 16 lbs. per 1,000 lbs. live weight, thus giving a more nutritious and at the same time a drier ration as maturity was approaching. During this second period the average weight rose from 1,164 lbs. to 1,255, or nearly 8 per cent., and the food consumed was converted into 3,525 lbs. of live weight. The cattle were now visibly fat, and could have readily been sold, but were not quite prime, and required finishing. They were lazy and felt the heat, and showed signs of loss of appetite. At this juncture, on a particularly warm afternoon one animal died, apparently from syncope. This has necessitated all the calculations being based on the remaining 39 head. It is noteworthy that this beast had ceased to increase in weight, as in the case of No. 6, and that although by no means overfat, it had reached its limit. It showed no indication of ill-health till just before it dropped dead.

The third or finishing period lasted from three to five weeks. It is therefore for comparison only possible to take the figures for the first 21 days and the final weights of the animals kept back, for the later consignments are heavier than those here given. The actual weights are of course taken in dealing with losses on the journey and slaughtering weights. The standard diet for the last period per 1,000 lbs. live weight was:—Maize meal, 6 lbs.; bean meal, 2 lbs.; ground nut meal, 2 lbs.; sunflower, 1 lb.; with 16 lbs. hay, 18 lbs. velvet bean hay and 8 lbs. of mangold. The actual feed given each day is shown below:—

Maize	7.75 lbs.
Veld hay	9.25 lbs.
Velvet bean hay	23.5 lbs.
Mangold	10.5 lbs.
Ground nut meal	2.5 lbs.
Velvet bean meal	2.5 lbs.
Sunflower meal	1.5 lbs.

The change was beneficial, as the increment continued good, and the animals improved, in some cases leaving at the last little room for further fattening so far as could be seen on stock of this class.

Increase.—The average increase in weight per head per week was 16 lbs., or upwards of 2 lbs. a day, throughout the whole fattening period. The average initial weight was 1,023, and the average weight at the end of the fattening period was 1,299 lbs., a gain of 276 lbs. The actual weight of each animal was taken weekly, but only the figures at the end of each period are given in Table II., whilst the total increase for each week and the average increase per head and the percentage increase are given in Table III. In considering the increase in value obtained from the food given it must be recollected that this is not represented by the increase in weight only, but also by the higher value per 100 lbs. of the fat ox as compared to the animal in store condition. There is not only an addition of pounds, but an enhancement of the value of every pound that the beast originally weighed.

Journeys.—In order to ascertain the losses in weight incurred and the actual costs involved in forwarding fat stock to Johannesburg, and to secure authoritative reports upon the quality of our stall-fed oxen, it was decided to consign the cattle to Newmarket, Johannesburg, and to dispose of them through the municipal agency there. In sending fat stock for slaughter to a distant market there is always an element of risk greater than if sold out of hand on the farm or at a neighbouring market where the trend of prices can be known before despatch. To eliminate as far as might be these disturbing influences and to avoid overloading the Johannesburg market with high-class beef—which even the numbers dealt with under this experiment were likely to do—the thirty-nine stall-fed cattle were distributed over three consignments at intervals of a week, thereby also for our calculations securing the advantages of a wider average of travelling conditions, delays, fatigue, bruising and weather, as well as of market fluctuations and demand. There is a very evident disadvantage under which we in Rhodesia labour to-day in consigning our stock to distant markets where stock on arrival must be sold

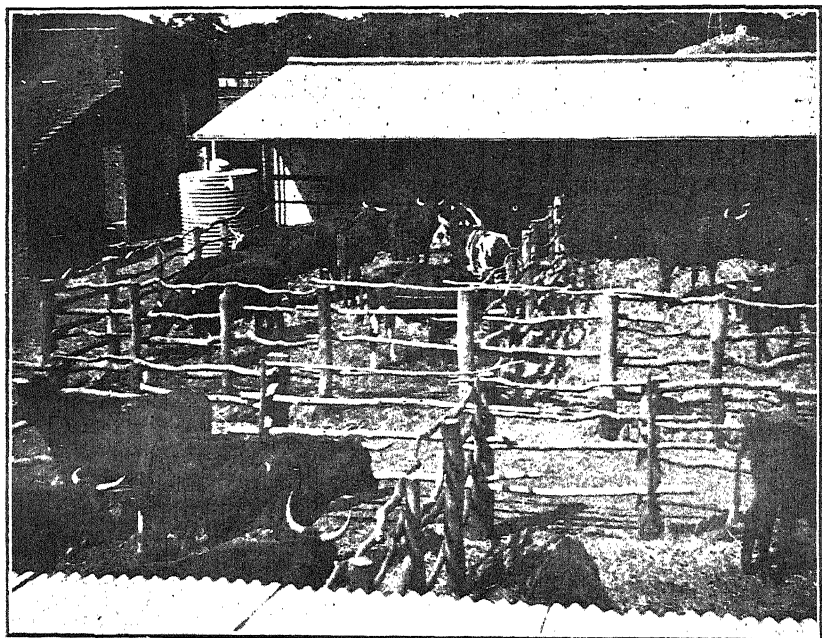
without the possibility of return or postponement regarding which the consignor cannot so far in advance have reliable information. The element of chance is pronounced.

The first consignment travelled without bruising and arrived in cold weather very favourable for the meat. The second consignment experienced some bruising, probably through shunting, and arrived in extremely hot weather, which was against the meat; whilst the third and last consignment, which was longest on the way and arrived on a hot afternoon, instead of early in the morning, though not in a bruised condition, was described as looking miserable after the journey. The cattle had to be kept in the lairs till the Thursday before being slaughtered, and on account of the great heat the meat had to be sold the same day. The veld-fed animals were sent with this last consignment, which experienced the worst conditions. The duration of the journey, including a halt and rest in pens at Bulawayo, was for the three consignments respectively 114, 117 and 122 hours, and from Bulawayo direct to Johannesburg, 50, 53 and 58 hours. In other parts of the world 30 hours is the legal limit for live stock to travel in one journey.

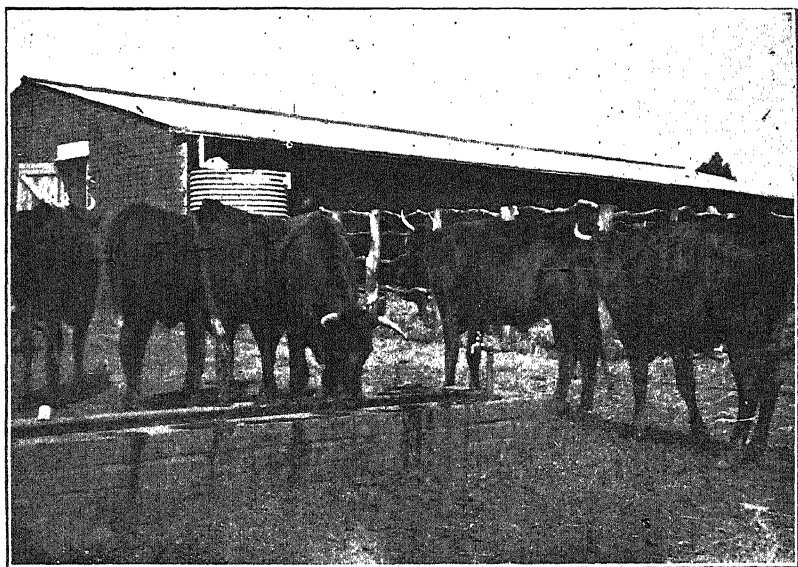
Loss en Route.—The first two consignments were slaughtered on the seventh, the third not until the eighth day after despatch. The duration of the journey, the unavoidable delay after arrival, the nervous excitement and fatigue of the journey, all involve losses, quite apart from risk of bruising and other injury, which are clearly reflected in the loss of weight *en route*, shown in Table IV.

It was not practicable to weigh two consignments of the cattle immediately on arrival, that is before feeding and watering, but in the case of the fifteen head, when this was done the losses were found to fluctuate from 120 to 200 lbs. live weight, averaging 163 lbs. per head, or no less than 11.75 per cent. of the weight at the outset of the journey. A considerable recovery was found to take place, fortunately, when the animals were fed and watered, and this may largely be regarded as restoration of flesh, since the tissues re-absorb their natural proportion of moisture and return to their normal condition owing to the nourishment given. This is known to be the case, since the meat of cattle not properly rested and fed and watered would be in a state unfit for consumption and likely to be condemned as "fevered." After such recuperation the difference of weight, compared to that immediately prior to despatch, amounted to 110.5 lbs. live weight per head on an average over the whole 39 head, or 8.36 per cent., a serious enough loss, equivalent, at 60 per cent. dead weight and 7d. per pound, to approximately 38s. per head. The wastage on veld-fed cattle would be very much greater than that of stall-fed stock.

Dressed Weight.—The measure of the condition of the cattle, or the degree of perfection to which the feeding had brought them, and the proof of the capacity of the cattle to be fed, are alike indicated by the proportion between the dressed weight and the live weight. The average figure of 60.5, an exceptionally high ratio, is most satisfactory, as showing that on a commercial scale Rhodesian-bred cattle can be brought



Oxen in pens.



Oxen at drinking troughs.

to a high degree of excellence. Of the 39 head, 26, or just two-thirds, were over 60 per cent., and three exceeded 63 per cent., quite an exceptional figure. The weights, both live and dead, were taken on the official scales of the Johannesburg Municipal Abattoirs and are certified by the authorities there. This very striking figure is the more remarkable in view of the fact that the average loss of weight, largely consisting of flesh and fat, during the journey to this extent, as indicated above, was 11.75 per cent. gross, or 8.36 per cent. after being fed and watered. The dressed weights averaged 732.2 lbs., which is just about an ideal export weight; ten head approximated very nearly to this figure; seven were heavy, over 800 lbs.; and six were light, 650 lbs. or less. These last also generally gave the lower dressed weight ratios.

Reports on Meat and Prices.—As regards the character of the meat, the following extracts from reports from the Acting Director of the Johannesburg Abattoirs are the best expositions that can be given:—

First Consignment, 11th October, 1920.—"The quality of the meat was first class, with possibly two carcasses which might have fallen into the second class. I am informed by one of the purchasers that the meat was better for the block than the prize cattle from the Witwatersrand Show. In regard to the difference in prices, which you will note range from 57s. to 69s., the competition for the 69s. carcass was very keen and accounts for the high price. I am informed by an English retail butcher of sound standing that he would have placed the meat in three grades, 1st, 2nd and 3rd, and that was his explanation of the variation in price. I cannot agree with this view, as in my opinion there were two grades, and only two carcasses which would fall into the second grade; these were the two which realised 57s. To obtain the highest prices I am satisfied that a consignment of sixteen cattle at one time is sufficient. The carcasses were extremely free from bruising; in fact there was not a mark on any of them."

Second Consignment, 18th October, 1920.—"The cattle killed out extremely well, and the quality of the meat was first class. The carcasses were all slightly bruised, but not sufficient for any condemnation."

Third Consignment, 28th October, 1920.—"This consignment arrived in a worse condition than the previous one. The eight stall-fed oxen killed out equal to the previous ones. The thirteen others were very disappointing; the meat was only suitable for the compound market, and was in fact an inferior compound. The compound market during the week was glutted, which accounts for the low price obtained. All the cattle in this consignment were fairly free from bruising."

The actual prices obtained may be given as under for the dressed meat, showing a remarkable fluctuation for what would generally be described as a level lot of uniform excellence. The average price of the dressed carcasses of the 39 stall-fed cattle works out at 61s. 11½d. per 100 lbs. dead weight, and the fluctuations were as shewn below:—

Two carcasses at 57s., one at 57s. 6d., one at 59s., four at 59s. 6d., four at 60s., three at 60s. 6d., two at 61s., seven at 62s., two at 63s., two at 63s. 6d., three at 64s., two at 64s. 6d., one at 65s., two at 66s., two at 66s. 6d., and one at 69s.

The thirteen veld-fed cattle all fetched the same figure of 26s. 3d. per 100 lbs. dead weight.

To all these prices must be added the prices of hides, which fetched 6½d. and 7d. per lb. on fresh weights; offals which varied from 12s. 3d. to 18s. 3d. each, the livers in some cases being condemned and detached, tongues and tails together at 3s. 6d. and feet at 1s. per dozen. These seem very low prices, in regard to which the seller is at an obvious disadvantage.

It is interesting to note that, whereas the carcasses were in all cases sound, eleven livers out of the lot had fluke or abscesses; one head had measles, and one pluck showed pericarditis. Although there was some bruising from the journey, there was not sufficient for any condemnations. The losses of £3 3s. 6d. on these counts were more than covered by the indemnity fund of 1s. 6d. per head, on which £2 18s. 6d. had been paid in.

Charges.—The charges of the Municipal Council through whom the cattle were sold are reasonable, especially when it is recollected that they settle railage and collect all payments and pay out promptly, and every attention to the stock is assured. The details of charges on the 52 head of cattle slaughtered in Johannesburg were as under:—

	Average cost per head.
Railage	£2 6 4
Abattoir entrance	0 2 6
Feeding	0 1 7
Handling	0 1 0
Weighing	0 0 3
Slaughtering	0 5 0
Lairage	0 0 4
Indemnity premium	0 1 6
	£2 18 6
Commission at 4 per cent. on price realised	0 17 6
Total per head	£3 16 0

With regard to the grazed oxen, the market authorities reported that on arrival they looked as if they had been ten days on the journey, though actually they had been five days, showing how much worse such animals stand travelling than do stall-fed stock. The striking difference between the veld-fed and the stall-fed cattle was enhanced by the fact that the compound meat market was at that time, as so often is the case, glutted, so that a low price only was obtained, viz., an average of £8 18s. 9d., which, after deduction of charges amounting to £3 8s. 3d., leaves only £5 10s. 6d. per head, a very low and unprofitable price, especially as it has to be compared to a clear £22 4s. 10d. for the stall-fed stock. The disparity is striking; the lesson to be derived is conclusive, and this experiment need not be repeated. The cattle used were of precisely the same age and class as the rest, except that some individuals, too wild to go on to the weighbridge or to take kindly to the kraals, were used, and evidently

these were not of a temperament to fatten well even when grazing on the old lands.

The history of one beast is somewhat interesting to follow. It was one of the lightest, weighing at the outset only 922 lbs. live weight. The rate of gain is satisfactory up to the eleventh week, a week when several animals had a set back and lost weight. This animal made only five pounds that week and then remained stationary at 1,065 lbs. for five weeks right up to the end. On the journey he lost fairly heavily, at the rate of 11.26 per cent., though three others lost even more. When killed he dressed well up to the average at 60.31 per cent., fetched 57s. per 100 lbs., and after veterinary inspection the pluck was condemned for pericarditis, though otherwise the carcase was sound.

Special thanks are due to Mr. A. C. Kirkpatrick, the Acting Director of the Johannesburg Abattoirs, for attention devoted to the consignments, and for full reports upon the results of slaughter and sale, which has added most materially to the value of the experiments. For the feeding, weekly weighing and care of the cattle during fattening, Mr. A. Wynn at the experiment farm, Gwebi, was responsible, and Mr. Bertram Woods has assisted in the calculations and preparation of the tabular statements, and to them acknowledgment is due.

Anyone interested in following up these experiments to the present stage may be referred to the following Bulletins, issued by the Department of Agriculture, Salisbury:—

No. 338. "From Breeder to Butcher. Feeding Experiment No. 5."

Nos. 331, 332, 340 and 345. "Notes on the Theory and Practice of Feeding Cattle."

No. 250. "Beef Feeding Experiment No. 3."

No. 245. "Beef Feeding Experiment No. 2."

No. 227. "An Experiment in Beef Production."

TABLE II.

LIVE WEIGHTS (IN POUNDS) AT DIFFERENT STAGES.

No.	At commencement.	After 1st period.	After 2nd period.	After 3rd period.	Actual increase.	Percentage increase.
1	950	1,125	1,230	1,275	325	34
2	897	1,060	1,155	1,205	308	34
3	1,070	1,200	1,275	1,300	230	21
4	1,012	1,160	1,225	1,260	248	24
5	925	1,055	1,150	1,185	260	28
6	922	1,020	1,065	1,065	143	15
7	1,072	1,240	1,350	1,315	323	30
8	940	1,020	1,150	1,195	255	27
9	952	1,050	1,150	1,185	233	24
10	1,089	1,250	1,345	1,395	306	28
11	902	1,020	1,090	1,080	178	19
12	967	1,155	1,230	1,270	303	31
13	967	1,060	1,165	1,185	218	22
14	1,027	1,190	1,290	1,345	318	30
15	1,044	1,200	1,265	1,280	236	22
16	1,062	1,240	1,320	1,360	298	28
17	1,113	1,215	1,365	1,425	312	28
18	1,132	1,160	1,285	1,325	193	17
19	1,134	1,280	1,370	1,420	286	25
20	1,067	1,135	1,225	1,260	193	18
21	1,167	1,350	1,425	1,465	298	25
22	1,103	1,250	1,335	1,385	282	25
23	1,132	1,315	1,405	1,445	313	27
24	1,243	1,445	1,565	1,635	392	31
25	942	1,045	1,125	1,160	218	23
26	912	1,005	1,095	1,135	223	24
27	887	1,050	1,065	1,100	213	24
28	1,054	1,175	1,270	1,335	281	26
29	928	1,110	1,205	1,250	322	34
30	952	1,105	1,180	1,225	273	28
31	958	1,145	1,225	1,290	332	34
32	1,007	1,170	1,265	1,340	333	33
33	982	1,125	1,195	1,285	303	30
34	1,027	1,070	1,185	1,240	213	20
35	1,127	1,310	1,410	1,455	328	29
36	Died	...	...	...	...	...
37	1,014	1,170	1,300	1,350	336	33
38	1,062	1,250	1,330	1,385	323	30
39	1,060	1,230	1,315	1,360	300	28
40	1,094	1,270	1,355	1,410	316	28
	39,895	45,425	48,950	50,660	10,765	...
Average for 39	1,023	1,164	1,255	1,299	276	26.9

TABLE III.

INCREASE IN WEIGHT OF CATTLE.

Week.	Pounds.	Average weight.	Total increase in weight per week.	Average increase in weight per week per head.	Average increase in weight per cent. per week.
Initial weight	...	1,023	...	...	...
1st week	...	1,032	Decrease 39	...	...
2nd week	...	1,070	1,885	48	4.6
3rd week	...	1,038	Decrease 1,211	...	...
4th week	...	1,079	1,613	41	3.9
5th week	...	1,098	742	19	1.7
6th week	...	1,120	840	21	1.9
7th week	...	1,143	899	23	2.0
8th week	...	1,163	766	19	1.6
9th week	...	1,182	765	19	1.6
10th week	...	1,200	675	17	1.4
11th week	...	1,215	600	15	1.2
12th week	...	1,238	890	22	1.8
13th week	...	1,246	335	8	.06
14th week	...	1,255	325	8	.06
15th week	...	1,270	605	15	1.1
16th week	...	1,282	450	11	.08
17th week	...	1,299	655	16	1.2
			12,045 - 1,280 = 10,765 net increase		

TABLE IV.
WASTAGE ON JOURNEY AND FINAL LIVE AND DEAD WEIGHTS.
(Weight in Pounds.)

No.	Immediately before despatch.	On arrival Johannesburg.	Gross loss on journey.	Percentage gross loss on journey.	After feeding and watering at Johannesburg.	Net loss on journey after rest.	Percentage loss after rest.	Dressed weight.	Percentage dressed weight to live weight in column 6.
1	1,275	...	...	...	1,190	85	6.66	736	61.84
2	1,205	...	...	...	1,150	55	4.56	687	59.73
3	1,300	...	...	...	1,210	90	6.92	743	61.4
4	1,260	...	...	...	1,155	105	8.33	711	61.55
5	1,185	...	...	...	1,105	80	6.75	629	56.92
6	1,065	...	...	...	945	120	11.26	570	60.31
7	1,396	...	...	...	1,300	96	6.87	808	62.15
8	1,195	...	...	...	1,130	65	5.43	650	57.52
9	1,185	...	...	...	1,125	60	5.06	638	56.71
10	1,395	...	...	...	1,290	105	7.52	765	59.3
11	1,080	...	...	...	990	90	8.33	610	61.61
12	1,270	...	...	...	1,165	105	8.26	732	62.83
13	1,185	...	...	...	1,080	105	8.86	622	57.59
14	1,345	...	...	...	1,265	80	5.94	753	59.52
15	1,280	...	...	...	1,200	80	6.25	737	61.41
16	1,360	...	...	...	1,285	75	5.51	758	58.98
17	1,500	...	...	...	1,370	130	8.66	830	60.58
18	1,380	...	...	...	1,230	150	10.86	747	60.73
19	1,440	1,300	140	9.72	1,360	80	5.55	824	60.44

No.	Immediately before despatch.	On arrival Johannesburg	Gross loss on journey.	Percentage gross loss on journey.	After feeding and watering at Johannesburg	Net loss on journey after rest.	Percentage loss after rest.	Dressed weight.	Percentage dressed weight to live weight in column 6.
20	1,310	...	...	...	1,155	155	11.83	712	61.64
21	1,480	1,340	140	9.45	1,370	110	7.43	859	62.7
22	1,420	...	...	...	1,235	185	13.02	753	60.97
23	1,475	1,290	185	12.54	1,330	145	9.83	850	63.9
24	1,660	1,500	160	9.63	1,530	130	7.83	956	62.48
25	1,220	...	...	...	1,115	105	8.6	672	60.26
26	1,150	1,030	120	10.43	1,065	85	7.39	617	57.93
27	1,160	...	...	...	1,035	125	10.77	653	63.09
28	1,385	1,190	195	14.07	1,260	125	9.09	750	59.52
29	1,285	1,120	165	12.84	1,155	130	10.11	700	60.06
30	1,250	1,100	150	12.00	1,130	120	9.6	686	60.7
31	1,320	1,120	200	15.15	1,190	130	9.82	732	61.51
32	1,385	1,210	175	12.63	1,250	135	9.74	720	57.6
33	1,350	...	...	...	1,215	135	10.00	734	60.41
34	1,260	1,130	130	10.31	1,170	90	7.14	671	57.35
35	1,485	1,285	200	13.46	1,350	135	9.09	811	60.07
36	Died at (twebi	...	...	...	...	...	...	...	...
37	1,390	...	...	...	1,190	200	14.38	736	61.84
38	1,400	1,280	120	8.57	1,300	100	7.14	782	60.15
39	1,385	1,200	185	13.35	1,250	135	9.74	796	63.68
40	1,440	1,260	180	12.5	1,360	80	5.55	816	60.00
Average	1,321	1,223	163	11.75	1,210	110	8.36	732.2	60.5

Annual Report of Experiments :

EXPERIMENT STATION, SALISBURY, 1919-20.

[A Report of the more important Experiments conducted during the Year under Review.]

The season throughout the whole country was, as is generally recognised, an exceptionally favourable one for most crops, and yields, especially of maize, were correspondingly high. The rainfall for the season at Salisbury was as follows:—

October	2.3 inches	February ...	7.85 inches
November	4.79 ..	March	4.21 ..
December	6.86 ..	April	0.03 ..
January	4.16 ..	May	0.41 ..

30.98 inches

MAIZE EXPERIMENTS.

First Series, Maize Rotations.—The previous results of these trials are reported in the *Agricultural Journal*, Vol. xvi., No. 6, December, 1919.

Plots 1-10th acre each in area; variety Salisbury White; hand-planted, 42 inches by 16 inches, 26th November, 1919; misses filled in 6th December; subsequent cultivation, twice horse-hoed and twice hand-hoed.

Plot No.	1919-20 yield, in bags of 203 lbs. per acre.	Average in bags per acre for previous years.	Average in bags per acre up to present date.
1. Maize continuously— 7th year	11.5	5 years, 6.18	7.06
2. Alternate maize and bare summer fallow	20.5	4 years, 10.25	12.3
3. Three-course rotation— Maize	20.9	4 years, 11.02	13.0
Velvet beans	6.5 (seed)	1 ton hay	1 ton hay
Wheat	3.5	2.5	2.7
4. Four-course rotation— Maize	20.1	3 years, 13.5	15.15
Wheat	2.5	2.15	2.24
Velvet beans	8.25 (seed)	1 ton hay	1 ton hay
Mangels (receives 6 tons kraal manure per acre)	3 ton potatoes*	10 tons roots	10 tons roots

*Three sowings of mangel failed. Potatoes were then put in, but with inferior seed and planted very late, resulting in the small yield recorded.

The marked effects of so favourable a season are clearly reflected in the very high maize yields as compared with the average of the previous five years. It will be noted, however, that the relative yields closely correspond except in the four course rotation where kraal manure is applied. Here the increase of the grain yield as compared with that in the other maize plots is not so marked, although the vegetative growth was more vigorous throughout. The benefits to be derived from a system of rotation, however, are quite as clearly indicated as in previous years.

Second Series, Maize Rotations, Commenced 1919-20.—Treatment as for previously described rotation experiments. These rotations are an attempt to apply in a practical manner the lessons learnt in the first series. While maize remains so dominant a crop in Rhodesia neither of the rotations alone would probably be practical on most maize farms, but there is no reason why by a combination of the two an efficient and practical rotation should not be devised.

Plot No.	Yield in bags per acre.
1. Maize, unmanured, Check Plot (continuous as in Plot 1, first series)	25.5
<i>Four Course Rotation.</i>	
The land receives kraal manure once in four years, and during the same period one fine strawed crop is grown and the stubble turned under.	
2. Maize (received 8 tons kraal manure per acre)	26.0
3. Maize—unmanured	23.7
4. Sudan grass (stubble ploughed under)	$\frac{1}{2}$ ton hay p.a. (estimated)
5. Maize—unmanured	24.6
6. Maize—unmanured, Check Plot (continuous as in Plot 1)	23.3
<i>Four Course Rotation.</i>	
Maize receives 150 lbs. Complete Artificials per acre once every four years, and during the same period one crop of velvet beans is turned under for green manure.	
7. Maize (plus 150 lbs. Safco Fertiliser per acre)	23.1
8. Maize—unmanured	23.0
9. Velvet beans ploughed under	—
10. Maize—unmanured	19.2

The land on which these trials were laid down has been under crop for seven years, and during that period has received only one dressing of kraal manure at the rate of about 6 tons per acre. Apart from this it has had no special treatment except that afforded by the general plan of rotation followed on the station, which provides that maize alternates with legumes and fine strawed crops. It is interesting to note that the maize on Plot 1 followed a previous crop of linseed, which apparently, therefore, had no exhausting effect on the soil.

The reason for the gradual decrease in yield from east to west of the block is not apparent, unless it is that the land at this end was

more subject to wash during the excessively wet seasons of 1916-17, 1917-18. On the whole these returns—though individually greater, which may be accounted for by the kraal manure previously applied—confirm the value of crop rotation as shown by the results in the first series. Their full significance will, however, not become apparent until their first cycle has been completed.

It is of interest to note that kraal manure on Plot 2 has accounted for the largest yield of any, and the fact that the increase over the unmanured Plot No. 1 is not greater may be due to the fact (1) that the manure was not of high quality, or (2) that the land had reached its maximum cropping capacity without the aid of highly concentrated fertilisers to balance the plant food supplied by the kraal manure. On the other hand there seems no reason why the Safo on Plot 7 failed to show any appreciable increase over the unmanured plots on either side.

Maize following certain other Crops.—Supplementary to the systematic crop rotation trials, experiments are also in hand to test the effect on maize of various "previous" crops. To this end blocks of land cropped the previous season with maize, cowpeas, oats and velvet beans were this season all sown to maize. Up to the year 1918-19 the land had been worked to a rotation of these four crops. At the same time a simple date of planting trial was carried out. The results were as follows:—

	Sown 15-11-19. bags per acre.	Sown 1-12-19. bags per acre.	Sown 15-12-19. bags per acre.
Maize after maize	13.9	10.3	5.6
Maize after velvet beans	21	21.4	11.5
Maize after cowpeas ...	17.5	12.6	8.7
Maize after oats	20.9	12.2	4.3

In the previous year both velvet beans and cowpeas were grown for seed, and the roots only and such leaves as had fallen ploughed under. The cowpeas were, as usual on this station, a poor crop; the velvet beans a good one. The outstanding features of importance in these results are:—

- (1) The marked advantage of a change of crop.
- (2) The increased yield after a straw crop, the stubble of which is ploughed under, thereby supplying organic matter to the soil.
- (3) The still greater yield when the previous crop has been a legume.
- (4) The outstanding merit of velvet beans as a previous crop.
- (5) The advantage of early planting in a normal season on the high veld.

A study of the results clearly shows how uniformly a previous crop of velvet beans has benefited the soil, no matter at what date the maize was planted. A further feature not indicated by the results, but very apparent in the field, was the forcing effect on the crop following velvet beans, this maize in each case being taller and four to seven days earlier in flowering than that on adjoining plots.

The relatively reduced yield after oats from the 1st December and mid-December plantings as compared with the earliest planting is possibly accounted for by the proximity of these plots to large native timber growing on the edge of the field.

Percentage of Maize Plants in a Stand.—The yields quoted above and obtained on land fairly typical of the red soil of the Territory and without manure (except when specified) may seem high when compared with the averages obtained generally in Rhodesia. In this connection it must be borne in mind that the percentage of plants in the stands at the experiment station is very high, due to the good tilth to which the land is worked, to hand planting and to second sowing where germination has failed on the first sowing. In the rotation trials the percentage of plants in the stand was as high as 95 per cent., made up as follows:—

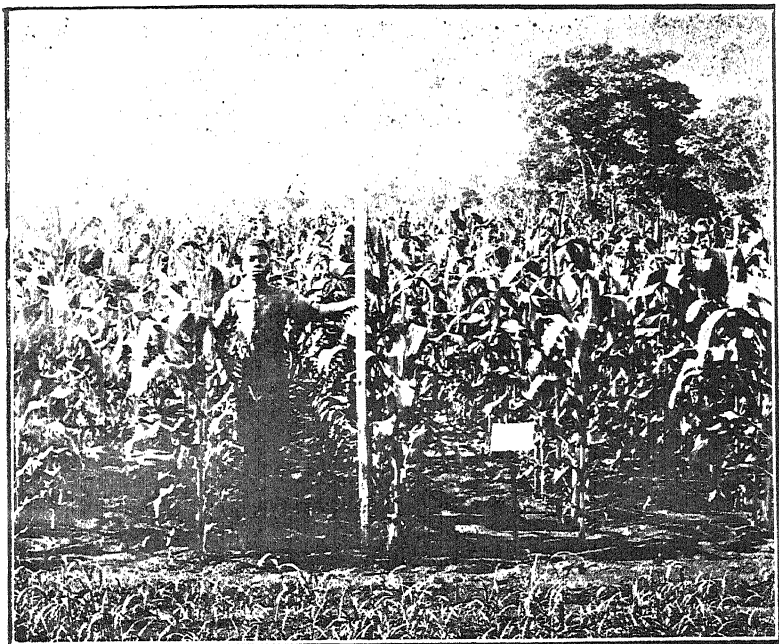
1st planting, 79 per cent.

2nd planting, 16 per cent.

Practically all the plants from the first planting bore cobs, of the second planting 10 per cent. or about two-thirds bore cobs, making a total of 89 per cent. fruitful plants in the stand. The average yield over these plots was 18.2 bags of grain per acre. The replanting was done as soon as it was seen that no germination had resulted—usually within ten days of the first planting. The best stand on the experiment station was a plot grown after velvet beans the previous season, where 98 per cent. of plants were obtained, of which only $1\frac{1}{2}$ per cent. was due to necessary replanting. The yield here was 21.4 bags per acre. The average of all stands over the whole station was 88.7 per cent. of plants, and the average yield was 14.4 bags per acre. An estimate of the plants in good average stands of maize in various parts of Rhodesia, made some years ago, showed a mean of only about 60 per cent. Assuming maize to be planted in rows 42 inches apart with 18 inches between plants, a full stand will contain 8,297 plants. If each of these plants on an average produces six ounces of shelled maize, then the full stand should yield $15\frac{1}{2}$ bags of grain per acre. Many crops in this country of course yield very much more than six ounces of grain per plant, but these figures will serve to demonstrate to how great an extent percentage of plants in a stand affects the final yield.

Other Maize Experiments.—All these tests were planted on the same day in rows three feet four inches apart and 18 inches between the plants. To ensure the plots being as even as possible, this was done by hand; two grains were dropped at intervals of 18 inches, and an excellent germination was secured. When the plants were about six inches high they were thinned out, only one plant being left every 18 inches. They received the same cultivation, being hand-hoed at intervals as required; by this means the land was kept quite free from weeds. The weather conditions throughout the growing season were favourable, good rains alternating with sunshine. All tests were very free from disease and insect pests.

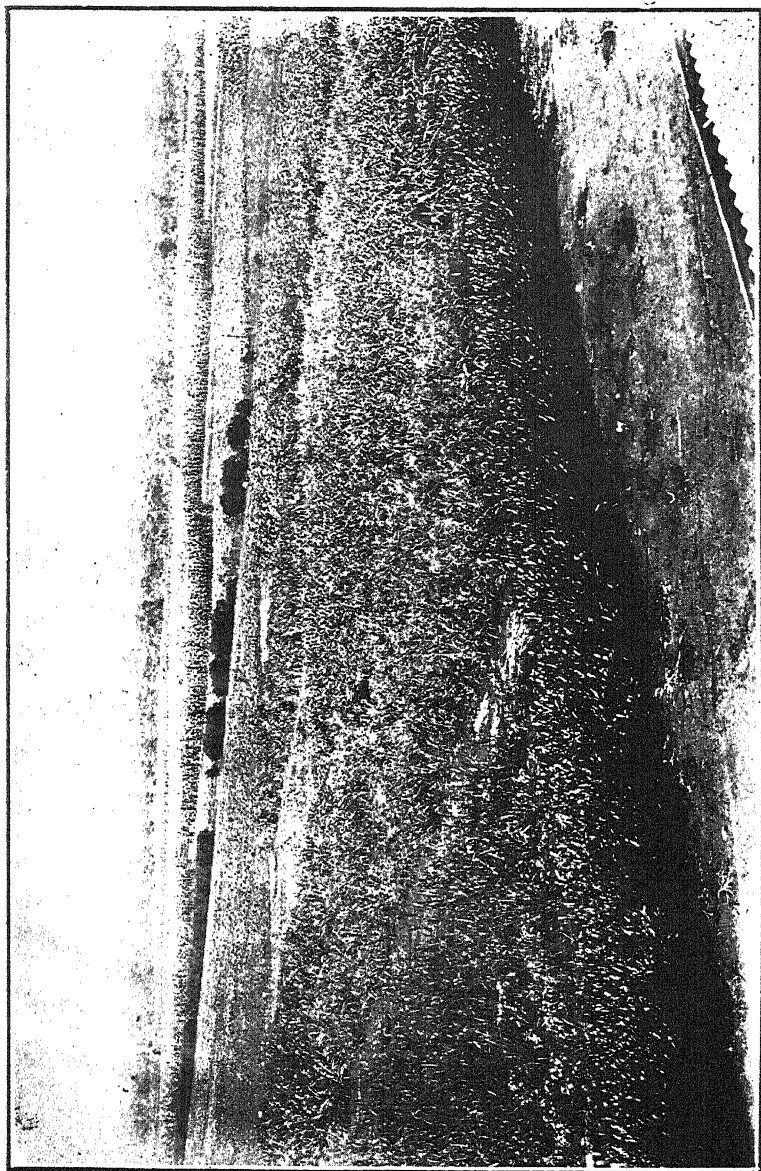
Experiment No. 1: Growers' Test—12-row Salisbury White.—This test was conducted to determine the fixity of the 12-row type; 12-row



No. 1. Maize after oats, Experiment Station, Salisbury.



No. 2 Maize after velvet beans Experiment Station, Salisbury.



View of some of the plots on the Experiment Station, Salisbury.

ears of this variety for seed were obtained from the five growers mentioned below. Very little difference was observable in any of the five lots during the growing season.

TABLE SHOWING RESULTS OBTAINED FROM GROWERS' TEST.

12-row Salisbury White.

Source of seed.	No. of 8-row cobs.	No. of 10 row cobs.	No. of 12-row cobs.	No. of 14-row cobs.	No. of 16-row cobs.
F. C. Peek, Concession...	21 8 p.c.	54 20.5 p.c.	163 61.5 p.c.	23 8.5 p.c.	4
D. Black, Selby ...	...	17 7.5 p.c.	172 73.5 p.c.	45 19 p.c.	...
C. C. Townsend, Salisbury	6 2 p.c.	50 18.5 p.c.	184 68.5 p.c.	26 9.8 p.c.	2
E. J. F. Smith, Makwiro	13 4 p.c.	88 28 p.c.	199 63 p.c.	12 4 p.c.	3
Agricultural Experiment Station, Salisbury	2 1 p.c.	55 20 p.c.	204 75 p.c.	9 3.5 p.c.	2
Total ...	42	264	922	115	11
Average ...	3.1 p.c.	19.5 p.c.	65 p.c.	8.5 p.c.	8 p.c.

Acre Yields of above Strains.

Source.	Yield per plot.	Area of plot.	Yield per acre.	Previous crop.
F. C. Peek ...	122 lbs.	1/16 acre	11.0 bags	Beans
D. Black ...	123 lbs.	1/16 acre	11.1 bags	Beans
C. C. Townsend ...	142 lbs.	1/16 acre	12.8 bags	Beans
E. J. F. Smith ...	148 lbs.	1/16 acre	13.3 bags	Beans
Agricultural Experiment Station	138 lbs.	1/16 acre	12.4 bags	Beans

Experiment No. 2: Row Number Test—Variety, Salisbury White.—
The purpose of this experiment was to determine, if by planting ears of the above variety with a definite number of rows, a majority of the progeny would produce the same number of rows as the parents.

Source of seed.	Rows in parent ear.	Produced 8-row ears.	Produced 10-row ears.	Produced 12-row ears.	Produced 14-row ears.	Produced 16-row ears.
Gwebi Experiment Farm	10	15 21 p.c.	26 36 p.c.	28 39 p.c.	3 4 p.c.	...
do.	12	5 5.5 p.c.	36 40 p.c.	41 45.5 p.c.	8 9 p.c.	...
do.	14	2	26 23 p.c.	58 52 p.c.	23 20 p.c.	3 2 p.c.
do.	16	2 4 p.c.	10 20 p.c.	28 56 p.c.	9 17 p.c.	2 4 p.c.
E. J. F. Smith, Makwiro	10	6 9 p.c.	22 35 p.c.	30 47 p.c.	6 9 p.c.	...
do.	12	5 7 p.c.	19 25 p.c.	43 51 p.c.	8 11 p.c.	...
do.	14	7 9.5 p.c.	21 28 p.c.	31 42 p.c.	12 16 p.c.	3 4 p.c.

Experiment No. 3: Maize Varieties Test.—Six varieties were planted for this purpose. The flint varieties matured three weeks earlier than the dent varieties. The yield of early flints was much lower than that of the late maturing dents.

Breed and variety.	Source of seed.	Area.	Yield.	Per acre.
Early Flint ...	Union of South Africa	1/11 acre	90 lbs.	4.9 bags
Cango (flint) ...	Union of South Africa	1/11 acre	138 lbs.	7.6 bags
Salisbury White (dent)	Gwebi Experiment Farm	1/11 acre	254 lbs.	14 bags
Potchefstroom Pearl (dent)	Potchefstroom ...	1/11 acre	234 lbs.	12.8 bags
Hickory King (dent)	Lomagundi ...	1/11 acre	210 lbs.	10.3 bags

Treatment.—Previous crop maize and velvet beans grown together for ensilage

Experiment No. 4: Effects of Topping Maize Plant.—A small experiment was conducted to test the effect of topping maize plants before tasselling, the object being to test whether such action could be practised in removing the tops of plants affected by stalk-borer. This proved to be a most interesting experiment, and will be continued. The results were as follows:—

Date when topped.	Height of plant before topping.	Height after topping.	Growth of plant after topping.	Area.	Yield.	Per acre.
29th Jan.	2 ft. 9 in.	1 ft. 6 in.	16th Feb., 4ft. 6in.	1/37 acre	48 lbs.	8.9 bags
29th Jan.	2 ft. 9 in.	1 ft.	16th Feb., 4 ft.	1/37 acre	20 lbs.	3.7 bags

Note.—The plants in question had not been attacked by stalk-borer, but it will be noticed that the more severe topping has resulted in the smaller yield. The tests are being continued, and a sufficient number of plants were hand pollinated to provide seed for this purpose.

LIMING TRIALS.

These were initiated three seasons ago on the suggestion of the Assistant Agricultural Chemist, who thought that owing to the acidity of certain of the red soils of this country, including those of the experiment station, a light dressing of lime might prove beneficial. Applications of half a ton of slaked lime over one acre and one ton of unburnt lime over another acre were first made. One acre was left untreated. Each one of these blocks was sub-divided and sown to different crops. As the relative effect of these light dressings was not apparent during the first two years, no useful purpose would be served by publishing full details of the crop yields, but to carry the test further, the dressings were repeated this season, slaked Que Que lime being, however, used on both plots. The results obtained were still inconclusive as to the beneficial effects or otherwise of the application. It can be stated, however, that no marked general increase in yield of grain or hay can be attributed to the use of lime in the case of any of the crops. The yields per acre for this last season are given below :—

Crop.	Half ton slaked lime 1917-18; half ton slaked lime 1919-20.	No lime.	One ton unburnt lime 1917-18; one ton slaked lime 1919-20.
Ground nuts	1,014 lbs.	930 lbs.	1,176 lbs.
Maize	2,640 lbs.	2,712 lbs.	2,472 lbs.
Beans	678 lbs.	438 lbs.	390 lbs.
Summer wheat ...	324 lbs.	486 lbs.	456 lbs.
Boer manna	798 lbs.	1,170 lbs.	1,410 lbs.

The analysis of the slaked lime used in 1919-20 was as follows :—

Calcium hydrate (slaked lime)	58.29 per cent.
Calcium carbonate (unslaked lime) ...	14.27 „
Magnesium hydrate	6.94 „
Moisture	16.93 „
Silica and silicates	3.10 „
Oxide of iron and alumina	0.47 „

Total 100.00 per cent.

better yield than ever recorded before for this Territory. The Canadian Wonder beans alone failed to respond to the exceptional season, although it must be admitted that in comparison with other similar varieties they were equal or superior to any of the newly imported kinds. Velvet beans produced record yields of seed, and in comparison with the Florida and Black varieties the "White Stingless" stands out distinctly superior in cropping powers. Woodforde's dolichos proved an excellent cropper, with exceptionally heavy growth of foliage, and will be tried more extensively. The Soy beans gave their usual light yield of grain, and cannot be recommended as a field crop. Cowpeas were persistently attacked by stem maggot, which prevented their proper development. This pest now seems to be prevalent almost throughout Rhodesia, and in only a few cases are good results reported. The yields of seed obtained from the more important of these crops are given below:—

White velvet beans (after wheat)	1,650 lbs. per acre
White velvet beans (average of four trials)	1,327
Black velvet beans	780
Canadian Wonder beans (best yield)	678
Canadian Wonder beans (average of three trials)	502
Tepary beans	936
Soy beans—Mammoth	450
Soy beans—Natal	414
Field pea (Black-eyed)	850
Chick pea (<i>Cicer arietinum</i>)	900

LINSEED.

A fairly comprehensive test with this crop was conducted, and owing to the favourable season satisfactory comparative returns were obtained. In one case the crop was grown for seed alone, in another for fibre and seed, and the results seem to some extent to uphold the feasibility of the practice obtaining in Australia of growing the same crop for both fibre and seed. The variety used in the trials was that known as "White Flowering," a variety which has given satisfactory returns over a great number of years at Salisbury. The average yield of grain when grown for seed alone was at the rate of 516 lbs. per acre. This yield is considerably in excess of that usually obtained in past seasons, and can be attributed to the even incidence of the rainfall during the growing period, one of the greatest obstacles to good yields with this crop in this country being its sensitiveness to spells of drought which may occur in course of the rainy season. This return was obtained from plots sown at the rate of 40 lbs. per acre and manured with 150 lbs. Safo per acre. The earlier sowings in mid-November gave higher yields in every case than the later ones in mid-December, and the best yield of 580 lbs. of linseed was obtained from a broadcast sowing made on the 20th November. When the crop was grown primarily for fibre and sown at the rate of 75 and 100 lbs. seed per acre, the average yield of seed fell to 450 lbs. per acre. In this case no fertiliser was applied, and the crop was partly drilled and partly broadcasted.

The plants were ready for harvesting in 15 to 16 weeks from the

date of sowing. Harvesting was done by pulling the plants out of the ground, tying in bundles and allowing to stand in the field until the lower capsules ripened out. Threshing was done with a small "Gem" thresher, the seed being subsequently winnowed.

In addition to the above the following varieties were also tested on a small scale:—Dutch. Large Seeded, Small Seeded, Riga, Yellow Seeded and Kostroma. Trials with these varieties on a larger scale will be made during the coming season.

SUCCULENTS.

A range of these crops was grown, including mangels, pumpkins, carrots, field radish, melons, cassava, yams, madumbies, arrowroot, etc. The abundant rainfall did not seem favourable to this class of crop, which, except in the case of mangels, on account of their succulence are particularly liable to injury from insect or fungoid attacks. Yams produced a yield of 25,000 lbs. of roots per acre from tubers planted out the previous season. Both cassava and arrowroot showed flourishing top growth, but no weights of these were taken. Sweet potatoes did well as usual, and an attempt is now being made to classify the various sweet potato varieties now grown in Rhodesia by name and to determine their value as croppers and the time required for maturity in each case. Madumbies do not appear to possess any advantage over sweet potatoes and yams as a field crop, except that they can be grown in wetter soils than are liked by the two latter crops.

OTHER EXPERIMENTS.

Much of the experimental work with crops requires several seasons for its completion. In addition to the trials reported on above, many others are in hand which will need to be conducted for several seasons before any definite conclusions can be arrived at, and these therefore are for the present omitted from the report. Trials are now being made to determine the comparative value of many leguminous crops as a preparation for succeeding crops of maize; to ascertain the effect of such previous crops as sunflower, Hibiscus cannabinus, linseed, cotton, etc., on maize; to ascertain the possibility of utilising Kikuyu grass, Kudzu vine and Penhalonga grass in pasture mixtures to form a sward under coarse fodders such as Napier fodder, mfufu and Guinea grass. Trials are also being made with the best of our native grasses, which are being grown separately in plots, to determine their comparative value for hay or pasture purposes. New and untried crops from other parts of the world are continually being introduced to test their adaptability to Rhodesian conditions.

Fuller reports on experiments conducted with Kudzu vine and Hibiscus and Sunn hemp for fibre have been made in separate articles.

H. G. MUNDY, Chief Agriculturist and Botanist.

J. A. T. WALTERS, Agriculturist.

C. MAINWARING, Agriculturist.

Control of Temperature in Dairying.

(*Concluded.*)

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

Temperature in Milk Production.—Whilst cleanliness is the first essential in the production of milk, prompt cooling and storage at low temperatures are the most important factors in preventing souring. Bacteria grow and multiply much more slowly in cold than in warm milk. When drawn from the cow milk has a temperature a little above 90 deg. F., a temperature at which bacteria multiply very rapidly. In many cases examined, milk within a few minutes of milking has been found to contain thousands of organisms per cubic centimetre. The organisms are derived from the air, the hands of the milker, the hair on teats of the cow, and particularly from the vessels in which the milk is received.

The rate at which these bacteria multiply is largely dependent upon the temperature. It was found that after 15 hours at 59 deg. F. milk contained 100,000 bacteria per cubic centimetre, whilst the same milk kept 15 hours at 77 deg. contained 72,000,000 per cubic centimetre, and at 95 deg. for 15 hours 165,000,000 per cubic centimetre. The importance of quickly cooling milk is thus evident, since usually it is desirable to hinder as much as possible the growth of bacteria. The micro-organisms which find their way into milk are of various types; in most cases, the majority are such as convert milk sugar into lactic acid, although others may be found objectionable, and others highly dangerous. The necessity for the prompt cooling of milk is therefore urgent, and the quicker the milk is removed from the milking shed to the place where it is cooled the longer it will remain fresh.

Cooling Milk on the Farm.—The operation of cooling milk is easily accomplished by means of that most common cooling agent, water. When a can of warm milk is placed in cold water, the heat from the milk passes into the water until the temperature of each is the same. The more frequently the water is changed, the more rapidly will the temperature of the milk fall, and therefore the most economical way of cooling milk is by immersing the can in a running stream of cold water. This means is generally adopted when milk is to be kept overnight for cheese-making purposes. The ideal method of cooling by this means is to have a concrete or stone tank, deep enough to take the cans, through which a constant stream of water flows. The overflow can be so arranged

as to keep the water at a uniform depth. A frame covered with wire mesh to cover the tank and fitted with a lock and key will prevent pilfering, and will permit of the lids of the cans being removed.

Surface Coolers.—To obtain the most rapid, efficient and economical cooling of milk a surface cooler should be used. An apparatus of this kind should be simple, durable and easy to clean and sterilise. Types of coolers such as are illustrated in Figures I. and II. are in common use. Through the cooler, water is constantly flowing, and where water is not laid on to the dairy an arrangement of tanks such as is illustrated in Fig. III. should be used. Where only small coolers are used, and

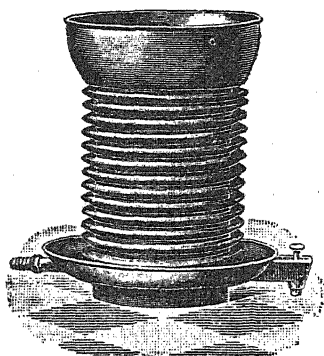


Fig. I.

Milk coolers. (Illustrations by Mr. H. T. White, Maritzburg.)

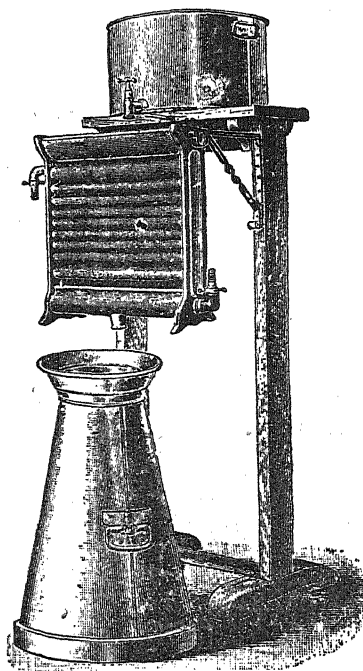
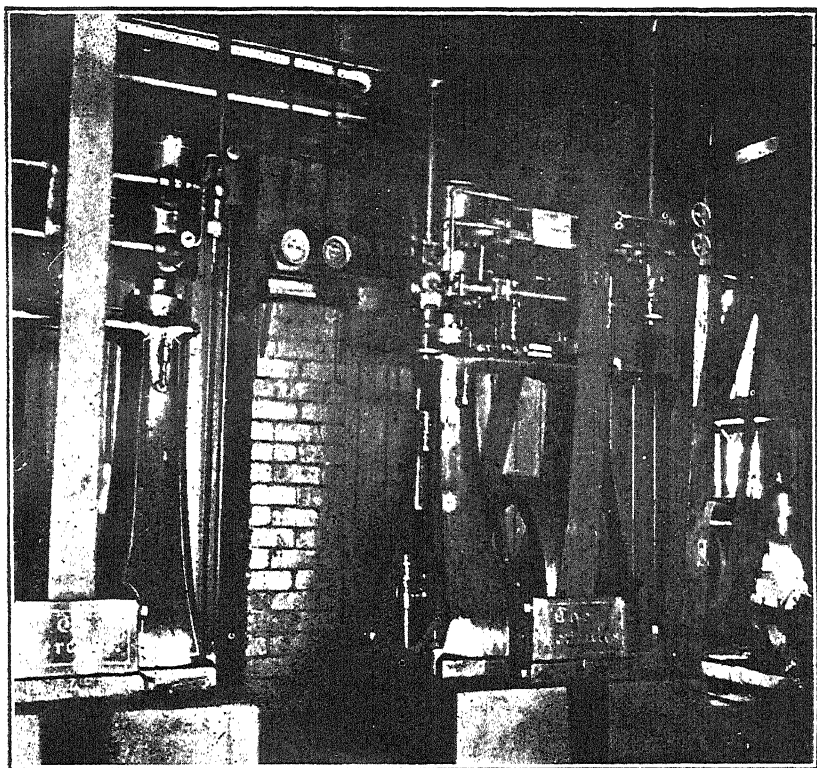


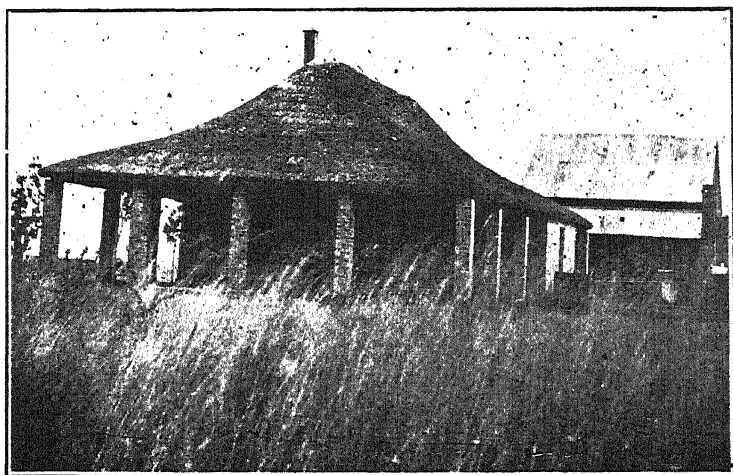
Fig. II.

where the temperature of the water is high, it is essential to pass the milk over the cooler twice. This will generally result in the temperature of the milk being reduced almost to that of the water. If the milk is to be kept on the farm overnight, the cans containing the cooled milk should be immersed in a running stream. An objection to the use of surface coolers is that the milk is exposed to contamination whilst passing over the cooler, and the dairy and the cooler itself must of necessity be kept absolutely clean and sweet.

Temperature in Cream Production.—In a previous Departmental Bulletin, "Cream and its Production," the necessity for cooling cream



Compressor for the refrigerating plant, Gwelo Creamery.



was fully dealt with, and a brief summary of the points will perhaps suffice. To obtain a first grade cream:—

- (1) Milk should be separated at a temperature ranging between 90 deg. and 96 deg. F.
- (2) Cream from the separator should be immediately cooled by stirring and by immersing the vessel containing it in cold water.

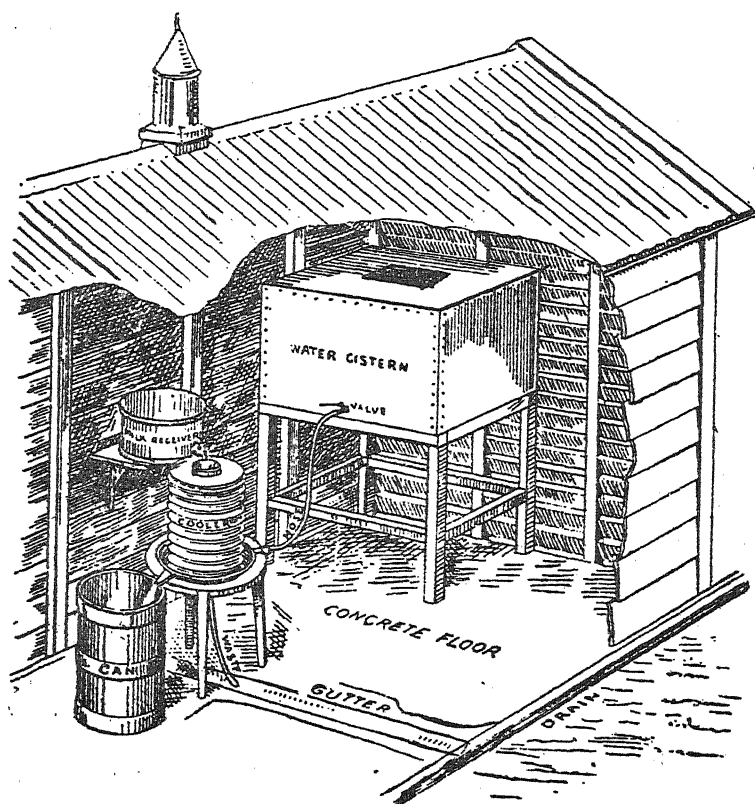


Fig. III.—Milk cooler, showing tank fittings. (Illustration by Messrs. Clarke Bros. & Brown, Johannesburg.)

- (3) Warm cream should never be mixed with cream already cooled.
- (4) Cans containing cream should be hung in a draught, and should be surrounded by a detachable jacket of sacking or flannel which is kept constantly wet.
- (5) Cream must be protected from the sun whilst being despatched to the creamery.

Proper cooling of cream is just as important or even more important than the cooling of milk, because cream is kept longer and is delivered

less frequently, and has therefore greater opportunity to undergo undesirable fermentations. Proper cooling is easily carried out with very little additional equipment and labour.

Rhodesia exported £25,116 worth of butter in the ten months January to October, 1920, and if we are to retain our markets and establish a name for the quality of our produce, it is essential to produce good flavoured cream. A visit to the creamery is a good object lesson in cream production, because the variations in quality of cream from different farms in the same district are enormous. Some samples are consistently good, whilst others are just as consistently bad. The good samples are the result of paying attention to small details and to prompt cooling of the cream after separation, whilst the bad samples are usually due to carelessness and inability to realise the consequence of neglect.

Pasteurisation of Milk and Cream.—It has already been pointed out how very suitable a medium milk is for the propagation of germ life. Germs are of course destroyed by heat, but unless the milk is raised to boiling point and retained at this temperature for a considerable time all spore forms are not destroyed; and to ensure the milk being absolutely sterile the treatment must be continued for one hour on three successive days. Sterilisation is not a practicable proposition because of the cooked flavours which are imparted to the milk, and because of the chemical changes which take place.

The system of pasteurisation differs from sterilisation only in the degree of heat used. Most active germs, *e.g.*, the tubercle bacillus, are destroyed when exposed to a heat of 165 deg. F., and the milk and cream can be safely exposed to this heat without developing any objectionable cooked flavour. Pasteurisation is often carried out on a small scale on the farm in hot weather, but any neglect to cool milk *rapidly* will result in no appreciable benefit being gained as far as keeping qualities are concerned. Rapid cooling of the heated milk is essential, and this is best achieved by immersing the bucket containing the pasteurised milk (or cream) in running water or by passing it over a cooler; and the lower the temperature at which the milk can be held, the longer will it remain fresh.

Temperature in Butter Making.—The use of a thermometer in butter making is essential, as the churning temperature must be regulated according to season. Churning at too high a temperature or churning at too low a temperature are equally prejudicial, and may result in prolonged churning, or what is commonly known as "sleepy cream." The following temperatures may act as a guide:—

Temperature of Dairy.

66 deg. F.
64 deg. F.
62 deg. F.
60 deg. F.
58 deg. F.
55 deg. F.
50 deg. F.

Temperature of Cream.

55 deg. F.
56 deg. F.
57 deg. F.
58 deg. F.
59 deg. F.
60 deg. F.
62 deg. F.

In summer every endeavour should be made to produce a heavy-bodied cream, which should be cooled in the manner already described, and it should be thinned by such a quantity of cold water or brine as will cause it to run freely off the wooden stirrer without clinging to it. By this means not only is the temperature reduced, but the cream will churn much more easily.

In winter the cream should be warmed up some hours before churning by immersing the jar or bucket containing it into another bucket containing water at 100 deg. F. When this water becomes cold it should be replaced until such time as the temperature of the cream is correct and the cream itself is ripe enough for churning. It is a bad principle to put warm water into the cream in order to raise the temperature.

When the cream breaks or small grains of butter appear, the temperature should be taken and a quart of water or brine at two degrees less than the churning temperature should be added. In summer, when it is impossible to get the temperature as low as is required for churning, this breaking water should be added a little sooner than would be considered advisable under normal conditions.

Washing water or weak brine is added after the buttermilk has been strained off, four degrees colder than the churning temperature. As a rule two washings are sufficient if the temperature has been properly controlled. To harden up the butter before being worked brine should be used, but it is never advisable to have this brine at a lower temperature than 48 deg. F. If the brine is too cold, the butter will become too hard and it will be difficult to work and to expel the surplus moisture. On the other hand, when the butter is too soft it is advisable to take the butter out of the churn after being brined, spread it out on a shelf or plate, cover it with wet muslin and expose it to a draught. This will harden up the butter and permit of its being worked and made up.

Temperature in Cheese Making.—When milk is to be kept overnight for cheese making it should be cooled in the manner already described. Next morning the cream should be removed and mixed with a good quantity of fresh warm milk and added to the overnight's milk, which has already been warmed up to 80 deg. F. When the warm morning's milk is added the mixed milk should be at a temperature approximating to 86 deg. F. (the renneting temperature), at which it should be maintained until ripe enough for the addition of the rennet. On cutting the curd the temperature should be about 85 deg. F. When "scalding" after cutting and stirring, the temperature should be raised slowly one degree every five minutes until 90 deg. F. is reached, then more rapidly until in normal circumstances the maximum scalding temperature (96 deg. F. to 100 deg. F., according to variety of cheese, condition of milk, etc.) is reached, in about 45 to 50 minutes. In the event of acid milk being used for Cheddar cheese making, the scalding process must be considerably hastened.

In Gouda cheese making the curd is vatted or moulded at a temperature exceeding 90 deg., whilst in Cheddar cheese making it should be placed in the moulds at a temperature of 79 deg. to 80 deg. F.

When ripening cheese the storeroom should be kept at a temperature approximating as nearly as possible to 65 deg. F. Here it may be mentioned that to maintain such a temperature in cheese rooms or dairies, it is essential to exclude the warm air of the day time by the provision of close-fitting doors and glazed windows fitted with blinds, which are opened in the early mornings for ventilation and shut again as soon as the day begins to get warm. If this principle is adopted, and the room is insulated both by double walls and an insulated ceiling, no great difficulty should be experienced in maintaining an equable temperature. Gauze windows without glass, and gauze doors, are useless in controlling temperatures, as the temperature inside the dairy fitted with these must be practically the same as the shade temperature outside.

In making cheese of the soft varieties, such as Camembert, Pont l'Eveque and Coulommier, it is essential to have the making room and the milk at a comparatively low temperature, say from 60 deg. to 62 deg. F. If too warm the drainage will be too rapid, and a small hard dry cheese will be the result. If the temperature is lower than that mentioned drainage will be too slow, and a great deal of whey will be retained and fermentation set up; the cheese will develop a bad flavour in consequence; and ultimately, if kept long enough, become a putrefying liquid mass.

Refrigeration in Creameries.—The principle underlying all systems of artificial refrigeration depends on the fact that all liquids on changing their state from a liquid to a gas absorb a certain amount of heat. Thus when ether is sprayed on any part of the body and vaporised, intense cold is caused by the absorption of the heat, and the part becomes numbed and insensible to pain. This absorption of heat is called the latent heat of vaporisation, and as already mentioned in this article, a pound of water on being vaporised requires 966 units of heat to enable this change to take place. This amount of heat is abstracted from surrounding objects and under ordinary pressure is fixed for each class of liquid, and can only be altered by altering the pressure above or below the atmospheric pressure. For artificial refrigeration it is necessary to select a liquid the boiling point or vaporising point of which is low enough to enable it to absorb heat at the temperatures required, and of the many liquids used, the most common are liquefied carbonic acid and ammonia.

An ammonia refrigerating plant such as is installed in the Gwelo Creamery, of which an illustration is given, consists essentially of four parts:—

- (1) Expansion coils, which line the walls of the cold chamber and the brine tank, and in which the ammonia is expanded from a liquid to a gas.
- (2) The compressor, which is a double acting vapour pump pure and simple, its function being to draw the expanded gas from the expansion coils and deliver it in a compressed state to the condenser.
- (3) The condenser, where the hot dense gas from the compressor

is cooled by the water flowing over the tubes, and returned to its liquid state.

- (4) The liquid receiver, where the liquefied ammonia is stored ready to be again allowed to expand through the expansion coils, and through its change from a liquid to a gas to produce intense cold. Theoretically there should be no loss of ammonia after the machine is once charged, but in actual practice it is found that with such a gas as ammonia, which so easily diffuses, a certain amount of leakage is bound to occur, and the machine has to be re-charged from time to time.

By the use of such machines and the provision of properly insulated chambers, intense cold can be produced, ranging from freezing point to zero; and by the circulation of cold brine, ice can be produced and the temperature of both water and cream can be properly controlled. It is this control of temperature which enables a creamery to turn good cream into butter which will stand storage and enable it to be transported in good condition to distant markets.

St. O'Gorman Cattle Dip.

Mr. R. W. Albertson, Rhodesian manager for the St. O'Gorman Chemical Co., Ltd., East London, C.P., advertises the company's scientific cattle dip in our columns, and appends a list of suppliers, inviting other merchants interested in the agricultural implement trade to communicate with him or The Mashonaland Agency, Ltd., Bulawayo, or Power & New, Salisbury, if they desire to stock the dip. It must not be inferred that St. O'Gorman's is a new comer to Rhodesia. It has been freely used in several districts for about six years, but recently the company decided to extend their activities, and to that end appointed Mr. Albertson their chief Rhodesian representative.

Internal Defence.

By Major G. PARSON, D.S.O., Chief Staff Officer.

My notes appearing in the December issue of the *Rhodesia Agricultural Journal* dealt with the scheme of defence. The following notes deal with details in connection with the carrying out of the scheme.

The scheme has now reached the point where the Territory has been divided into eight military districts; these in their turn have been sub-divided into sub-districts, and the latter into sections. Commandants have been appointed to the districts, sub-districts and sections, and laager and rallying points selected. A letter has been printed and forwarded to District Commandants, which they are requested to forward to their Section Commanders through the Sub-District Commandants. These letters are to be filled in by Section Commanders and forwarded to the various residents in their areas. The contents of the letter notify residents what they are required to do in time of emergency.

When the provisions of para. 2 have been given effect to, the Territory may be said to have been organised for defence to a certain point. Residents have been advised what to do in time of emergency, and it remains now to instruct them how to do it. In order to accomplish this, Section Commanders have been asked to obtain certain particulars in regard to their areas. This entails a great deal of work on the part of Section Commanders, unless the farmer quickly responds in giving what information he feels he is able to give. It might here be pointed out that on the information the farmer gives will depend any arrangements the Section Commander may be able to make for his safety in time of trouble. Each Section Commander must know what families are to come into his rallying post in time of emergency; he should, therefore, have a list of them.

The next point he will have to decide is how warning can best be sent to these families in time of emergency, instructing them to concentrate on the rallying post. The difficulty connected with getting these notices out will be considerable, but must be overcome. Available European and native police messengers, mounted Europeans, motors, cyclists, telephones, telegraphs, preconcerted signals, etc., etc., are to be utilised. Nothing must be left undone, and it must not be left to the last moment. On receipt of this warning, how are residents to reach the rallying post? This can only be decided by knowing exactly what transport is available in the section, and this is information that should be given as early as possible. Some residents will be able to make their way to the rallying

post unaided; others will require transport. In each case the resident must know how he is to reach the rallying post, and what transport, if necessary, he can expect to assist him. Transport in the section should be divided into light and heavy, the former for bringing in the residents and the latter for supplies, etc.

It will probably be found that in some cases residents will require an escort to bring them into the rallying posts. The accepted principle is that it is the duty of a single man to assist married men with families or female dependants. He must, therefore, be instructed by the Section Commander whom to assist. It must not be left to the individual to decide, otherwise wastage of men and overlapping will be certain. The married man should know who is to assist him. In cases where single men are not available, other escort arrangements would have to be made. Every resident must bring in with him to the rallying post as much food as his transport can carry, also bedding. He will naturally bring in all riding animals, saddlery, etc., rifles and available ammunition. It is to be remembered that if he has no transport, the Section Commander will be acquainted with the fact, and would have endeavoured to arrange accordingly.

To enable the Section Commander to formulate the scheme of defence of his section, the resident should supply him with the following information. If the resident fails, or refuses to do so, it is at his own risk and peril. He cannot be compelled to furnish the details. A form will be sent out to each resident for completion, which will contain the following:—

- (a) Whether married; if so, whether his wife and family reside with him? Any other female dependants? The number and age of the children? The number and age of dependants?
- (b) Whether he has any transport for immediate use to bring in the above?
 - (i.) Motor car (carrying capacity) and amount of petrol usually in stock?
 - (ii.) Cape cart, spider or other trap or trolley, and what animals he uses in them?
 - (iii.) Animals for riding purposes, number and description, stating whether horse or mule?
 - (iv.) Fire-arms, number of rifles, guns, revolvers; calibre to be given?
 - (v.) Amount of ammunition for rifle, gun or revolver usually on hand?
 - (vi.) Transport wagons, number and carrying capacity; what oxen, mules and donkeys are available for them? Drivers, whether reliable, or if required?
 - (vii.) Supplies, amount of European foodstuffs usually available to bring in? Cattle he can bring in?
 - (viii.) Mealies and mealie meal that could be brought in on the transport wagons for animals and natives?
 - (ix.) Tools, picks, shovels, spades, sickles, crowbars, barbed or other wire?

What is to be done after concentration at the rallying post circumstances alone can decide; the questions to be determined are—

- (a) whether it is better to remain there; or,
- (b) to proceed to the district or sub-district laager.

If circumstances permit, the families of residents, *i.e.*, the women, children and those who are unable to assist in the defence of the post, will be sent into the sub-district laager, the men remaining at the rallying post to patrol the area vacated and to keep touch with adjoining rallying posts, and thus form a cordon of outposts around the sub-district laager. In this case it must be decided what steps are to be taken for the defence of the post and patrolling. The defensive portion should be decided on and a sketch shewing all details prepared.

If it is necessary to proceed immediately on concentration to the sub-district laager, how can this best be undertaken? Can it be carried out without assistance, or is assistance necessary? What route is to be taken? Details should be noted and recorded, so that in the event of anything happening to the Section Commander, his successor can carry on without confusion. The garrison of each rallying post will be divided into—

- (a) garrison for defence, *i.e.*, those who are immobile;
- (b) patrols and escorts, *i.e.*, those who are mobile and possess means of conveyance, such as motor car, motor cycles, bicycles, mounted men, etc.

The former will be used for the defence of the post against attack, whilst the latter will undertake active defence and form patrols to act in conjunction with those formed by adjacent sections, Police, mobile columns, etc., to either attack the enemy or keep a district in which no rising has taken place quiet by a show of strength as may be directed by the Sub-district Commandant. It should be possible to accomplish this to a great extent as soon as residents have supplied the information asked for.

To enable these roles to be carried out, it is very necessary that the site selected for the rallying post should be of a suitable size, to enable it to be defended by the numbers available. The site selected should—

- (a) be centrally situated, so that it may be
- (b) conveniently, easily and quickly got to by the majority of the residents who have to rally on it;
- (c) it must have a good water supply sufficient for man and beast;
- (d) it must be capable of being easily defended.

The chief requisites of a defensive position are:—

- (a) The extent of the position should be suitable for the strength of the garrison, and capable of affording accommodation for the residents of the area, animals, vehicles, etc.; as far as is practicable, a third of the garrison should be available for manning the outer defences, the remainder being placed in reserve for patrolling or assuming offensive tactics;

- (b) a clear field of fire and no dead ground within effective rifle range;
- (c) good cover for the garrison;
- (d) good water supply;
- (e) good grazing for animals.

The following points are to be noted in the defence of a post:—

- (a) organisation of inner and outer defences;
- (b) defenders should be quartered close to the positions they have to man;
- (c) arrangements are to be made for storage of arms and ammunition, water and supplies;
- (d) provision of strong obstacles around the post;
- (e) adequate cover with clear field of fire;
- (f) provision of automatic alarms, trap guns, etc.;
- (g) good communications within the perimeter;
- (h) sanitation and latrines;
- (i) defence of water if necessary.

In preparing buildings for defence, attention should be paid to the following details:—

- (a) bullet-proof barricade to doors and windows; a means of exit other than the usual doors to be provided, i.e., by tunnel underground, etc.;
- (b) loopholes are easier to make in the barricades than in the walls;
- (c) ventilation requires consideration if doors and windows are barricaded;
- (d) arrangements to be made for the storage of ammunition, provisions, water and sanitation;
- (e) orders as to extinguishing fires.

No portion of the perimeter should be unprovided with obstacles, which may be made with wire, abattis, stakes, staked pits, etc. They all afford good protection against surprise, and must never be neglected. They should be arranged to break up unity of action and cohesion of the attackers, and to deflect the parties thus isolated into the best swept fields of fire. They must also be capable of arresting the enemy under close fire of the defenders. They must not afford the enemy cover or obstruct the view of the defenders. They must be difficult to remove or surmount, and must therefore be anchored. If possible, they should be so placed that their positions are concealed from the enemy.

In preparing a field of fire it is not necessary that the surroundings should be cleared of all trees and undergrowth; it is better that these should be left, wherever possible, to afford concealment, and the lower branches only pruned to afford view to the defenders. All dead ground capable of affording cover to an enemy must be filled in with abattis, and if this is not possible, it may be necessary to dig in a small detachment to cover it. Range marks must be placed at varying points in front of each face of the perimeter, and these should be known to those manning the defences. The ranges can be indicated by marking the

trunks by blazing a pattern in the bark, *i.e.*, a diamond shape could represent 300 yards, a square 400 yards, a triangle 200 yards, and so on. In the absence of trees, range posts can be substituted. Obstacles must be carefully placed so as not to interfere with the field of fire.

As far as possible all defences must be camouflaged, and camouflage should follow the lines of nature. It is quite useless, for instance, to cut grass and throw it over the parapet or parados of a trench; light is reflected off the stems, which has the effect of showing up the defences. If the surroundings consist of grass, plant tufts of grass on the defences to blend with the rest of the area. Place yourself in the position of the enemy and view the defences from different ranges until concealment is to your satisfaction. Automatic alarms may consist of trap-guns arranged outside the outpost line, or trap-wires with tins with stones in them and hung by the lid on to the wire and so on.

The health of the garrison will depend greatly on sanitation, and too much trouble cannot be exercised in this connection. The post must be cleaned up daily, and all rubbish and filth destroyed by burning or by burial in a pit. Latrines for day and night use must be prepared and carefully looked after. Special attention is to be paid to the cleanliness of the transport lines, native lines, and so on. The water supply must be carefully supervised and not allowed to become fouled in any way. Drinking water for Europeans, natives and animals, and for bathing and washing purposes is to be marked off.

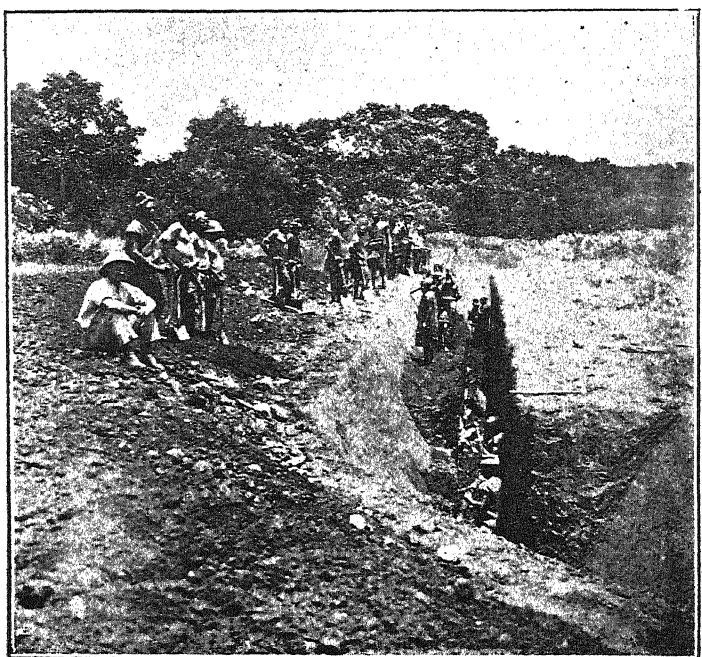
The Section Commander, it will be seen, cannot carry out by himself all the multifarious duties that will naturally occur, and he must, therefore, have assistance. This can best be managed by the appointment of others to control the various departments, *i.e.* :—

- (a) supplies, food, etc. ;
- (b) sanitation ;
- (c) medical and nursing ;
- (d) transport ;
- (e) a resident to assist the Section Commander generally, and so on.

These appointments will be made in the discretion of the Section Commander, and according to the numbers of the garrison.

With a small force it will be essential to get every person who can use a rifle to do so, and adult men should not be employed on any class of work that could be performed by women, provided the latter are available. During the Great War women were used with success in many capacities, and in so doing enabled a number of men to take their places in the firing line.

What kind of defences should be employed? This will depend entirely on the nature of the terrain the defensive post is situated on. If possible there should be an inner and outer line of defence, the outer line being as far out as possible compatible with safety. Any point which commands the defences must be denied to the enemy by occupying it with a detachment. Wherever possible the trench system should be adopted; but this may not be possible in every case, when other means



Irrigation scheme at Mr. A. G. Staunton's farm The Grove. Main canal during construction.

will have to be adopted, such as rifle pits, sangars, redoubts, etc. The outer line of defence will necessarily be too long for a continuous trench system. Entrenched posts, therefore, must be organised, each post being capable of supporting its neighbour, the intervening gaps being filled in with stout obstacles. These posts should have an all-round defence, *i.e.*, capable of resistance from any quarter in the event of surprise. They must support one another, consequently must not be too far apart. Each post is to be protected by obstacles as previously described.

It is not proposed that these defences should be prepared at once: their positions should be clearly defined on the plan of the position, and details as to construction recorded, so as to avoid confusion when an emergency does arise.

Irrigation Works.

We have pleasure in giving a brief description of a new irrigation scheme recently completed on Mr. A. G. Staunton's farm The Grove, in the Salisbury district.

The scheme takes water from the Umwindi River, and the main canal is led out at a point near the upper boundary of the farm. In order to prevent, as far as possible, damage by flood in its upper reaches, the canal is kept well back from the river, and in places has a depth of nearly 10 feet, as is shown in the accompanying illustration. The canal has a total length of about three-quarters of a mile, and will command some 40 to 50 acres of good soil on the left bank of the river.

A good weir site, with an excellent rock foundation, exists at the point of intake, and as soon as circumstances permit it is proposed to build a substantial masonry weir, with the necessary head regulating gates, at this point. In the meantime, however, a temporary boulder weir will be used.

Mr. Staunton is largely engaged in dairying and mixed farming, and intends, during the coming dry season, to grow various green crops for feed under irrigation and establish a small acreage of lucerne.

The construction of the works as so far completed was carried out in under two months at a very moderate cost.

Mr. N. Irvine undertook the contract for the canal excavation work, and the general design and lay out for the scheme was prepared by the Irrigation Engineer of the Department of Agriculture.

The Application of Water in Irrigation.

By A. C. JENNINGS, Assoc.M.Inst.C.E., A.M.I.E.E.,
Government Irrigation Engineer.

It is not proposed in this article to deal with the design and construction of irrigation schemes, as these are matters upon which professional advice should be obtained in almost each individual case. A very large amount of money has been wasted in the past in many countries through ill-considered and badly devised schemes of irrigation, and to avoid repetitions of such failures farmers and others should seek skilled advice before embarking upon schemes of any magnitude.*

It will be presumed here that the main portions of a scheme have been successfully completed and the water brought to the land which it is proposed to irrigate. The further steps which remain to be taken are of great importance if success is to be obtained in raising crops under irrigation. It must be recognised that to handle and apply water to a crop at the right time, and in the right amount without washing or puddling the soil, requires firstly that the land is prepared and laid out in a suitable manner for irrigation, and secondly skilful manipulation, good judgment and patience upon the part of the irrigator are essential.

Irrigation Terms.—Before proceeding further, it may not be out of place to give a brief description of the various terms used in irrigation.

Dam.—A bank or wall across a watercourse for holding up and impounding water which would naturally flow therein.

Weir.—A low wall placed in a river for raising the general level of the water and diverting the flow of the stream into an aqueduct.

Main Canal.—The canal connecting the source of supply with the land to be irrigated.

Head Regulator.—Sluice gates or other contrivances for controlling the supply of water to the main canal.

Flume.—A structure for carrying water across a valley between points of higher level.

Syphon (Inverted).—A line of pipes laid across a valley or depression for carrying water between two points of higher level.

*Advice upon irrigation is given by the Government Irrigation Engineers upon terms which can be supplied upon application to the Department of Agriculture, Salisbury.

Cross Drainage Works.—A structure built over or under a canal for discharging storm water and preventing its entry into the main canal.

Distributary Canal.—A minor channel for conveying water from the main canal to serve one or more areas of the land to be irrigated.

Field Furrow or Field Channel.—These are led off the distributing canals and convey the irrigation water direct on to the land.

Nature of Soils.—A proper understanding of the texture of the soil and sub-soil will assist largely in determining the manner in which the irrigation of a piece of land can be best carried out. For example, a soil that becomes more open in texture and coarser grained as the depth increases will absorb water downwards very rapidly, and a large proportion of the water applied will sink beyond the reach of the plant roots. To irrigate satisfactorily a soil of this kind the water should be spread evenly over the whole surface or be led in furrows closely spaced, so that the soil between the furrows becomes quickly wet. Where the reverse is the case, and the soil becomes finer in texture as the depth increases, there will be more lateral spread, permitting the furrows to be placed further apart and the water to be run more slowly over the ground.

The puddling and baking of soils are to be avoided as far as possible, as both affect the roots of the plants and do considerable harm to young growing crops. For crops like oats, wheat, barley, etc., it is always advisable to ensure that the soil contains sufficient moisture at the time of seeding to germinate the crop and carry it well forward, and thus avoid irrigation when the plants are very young. The washing of soil, generally due to using too large volumes of water on too steep slopes, must be carefully avoided; and with good irrigation the water should move gently over the land or in the furrows in such a way that it runs almost clear and does not erode. It must be borne in mind that the eroding power of water in motion varies as the square of its velocity. Thus water moving in an open channel at a velocity of 2 feet per second will have approximately one half the eroding power of the same volume of water moving at a velocity of 3 feet per second. A good irrigator should always have the water he is using under perfect control, as by increasing the irrigating head, i.e., the depth of water in the furrow, he can increase the rate at which it moves over the land. Conversely, if the velocity is too great and the soil washes, then either the stream can be divided into more furrows or the supply from the distributing canal decreased.

Levelling of Land.—Land in its natural state has seldom an even surface although it may appear so to the eye, and if the primary object of irrigation, namely, the diffusion of water evenly to the plant roots, is borne in mind, then the need of careful preparation of the surface of the land will be readily appreciated. To irrigate land having small mounds and hollows results in the former receiving insufficient water and the latter too much, with consequent ill-effects to plant growth. The amount of levelling necessary depends largely upon the natural slope of the land and the system of irrigation to be adopted. Land having a slope of from 2 to 10 per cent. is suitable for irrigation, and

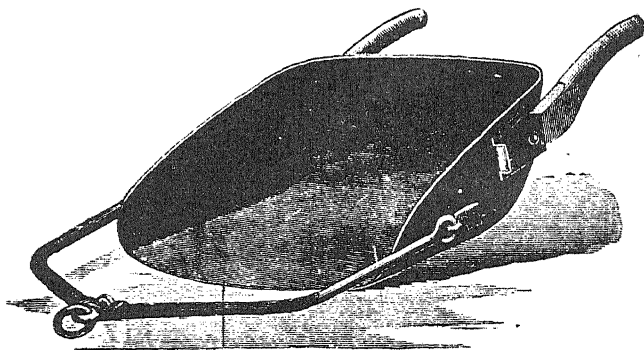


Fig. 1. Dam Scraper.

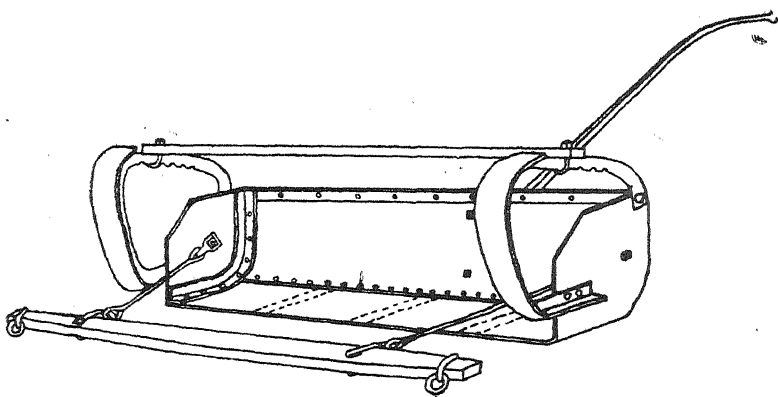


Fig. 2. Fresno Scraper.

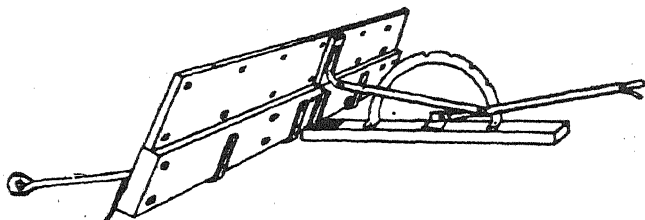


Fig. 3. Buck Scraper.

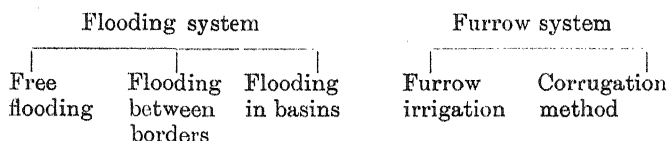
where the land is of great value even steeper slopes than the latter can be profitably worked. In this country, however, where land is still comparatively cheap, it is doubtful whether the expense involved in preparing very steep land for irrigation could be justified. The general aim in levelling land should be to secure a smooth, gently sloping or evenly graded surface.

For land levelling work on a small scale the ordinary scoop or "dam scraper" (Fig. 1) is a useful implement, and for more extensive operations a large scraper of the type of the American made Fresno scraper, illustrated in Fig 2, will be found very satisfactory. The latter can be adjusted to take off a thin or thick slice of earth and the load dumped as desired. The buck scraper shown in Fig. 3 can be made at small expense, and will be found suitable for most of the ordinary levelling operations.

The efficient levelling of land is the most important item in the preparation of land for irrigation. When citrus groves are being established, or perennial crops such as lucerne planted, any money expended in the initial levelling of the land will be saved many times over by the increased facility obtained for irrigation. In the case of citrus groves it is impossible to level the land after the trees are once planted. For cereals and ordinary crops a lesser amount of levelling is sometimes sufficient, but even with these crops a small amount expended will save endless waste of time in the subsequent handling of water on the land.

METHODS OF IRRIGATION.

Having levelled the land, the next consideration is the method of irrigation to be adopted, the decision of which will be largely influenced by the particular crops to be grown. There are two general classifications under which the various methods of irrigation can be grouped, and these are shown below:—



The flooding system is generally used in the irrigation of cereals, grasses, lucerne and such crops as do not require inter-tillage, while the furrow system is applied to rowed crops such as mealies, potatoes, tobacco, beans, garden crops, and very largely for orchard irrigation. The features of each will now be briefly described:—

Flooding System.—*Free Flooding.*—This is the oldest and perhaps the crudest method of irrigation; its use, however, is still fairly general in South Africa, and with skill good results can be obtained. In this method the field furrows, having a fall of about 2 feet per 1,000 feet, are led off the distributary canal and carried across the slope of the land. By means of temporary obstructions placed in these furrows the water either overflows or is led out through gaps in the lower bank. The irrigator with spade in hand coaxes the water over the surface until all the land between this and the next lower field furrow has been

wetted. The field furrows can be spaced from 50 to 200 feet apart according to the nature of the soil, slope of land and the water available, the areas between each furrow being of course levelled or graded as previously mentioned. For the greater facility in handling the water, small sluice gates can be placed at points where the furrows branch off the distributaries. The actual arrangement and spacing of furrows will vary with almost each piece of land, and are largely matters for the discretion of the farmer. In Fig. 4 an illustration is given which should convey a general idea of the lay-out of furrows for this system.

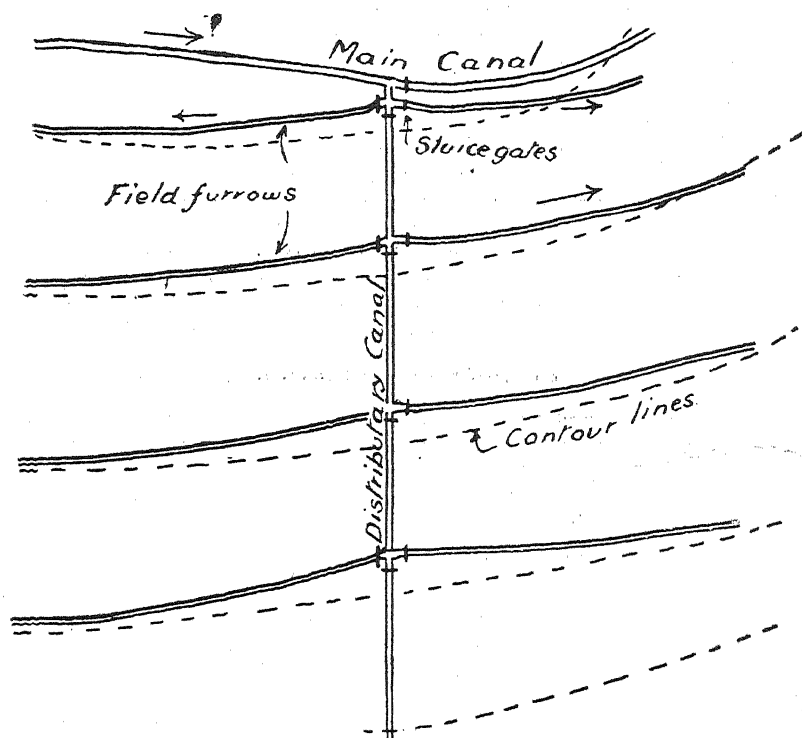


Fig. 4. Distribution by free flooding.

Flooding between Borders.—This system, illustrated in Fig. 5, is the one generally used for the irrigation of lucerne, permanent pasture grasses and similar crops. By its use a larger irrigating head can be used than with the previous system, which in soils of loose sandy texture is a very considerable advantage, and effects economies in both the water used and the time spent in irrigating. Where the general slope does not exceed 4 or 5 feet per thousand, parallel ridges or borders spaced about 30 to 50 feet apart, at right angles to the field furrows, are carried down the slope. The length of the borders between successive

cross furrows is from 250 to 400 feet, but the steeper the slope the longer and narrower may be each strip.

To apply the water the field furrow is obstructed by a temporary dam at the second border B shown in Fig. 5 at the top of the field, causing the furrow to overflow uniformly between the first and second borders. If a sufficient irrigating head is used the water flows slowly and uniformly several inches deep between these borders to the lower end of the strip. When a sufficient amount of water has been turned in to wet the strip to the lower end, the temporary dam is removed

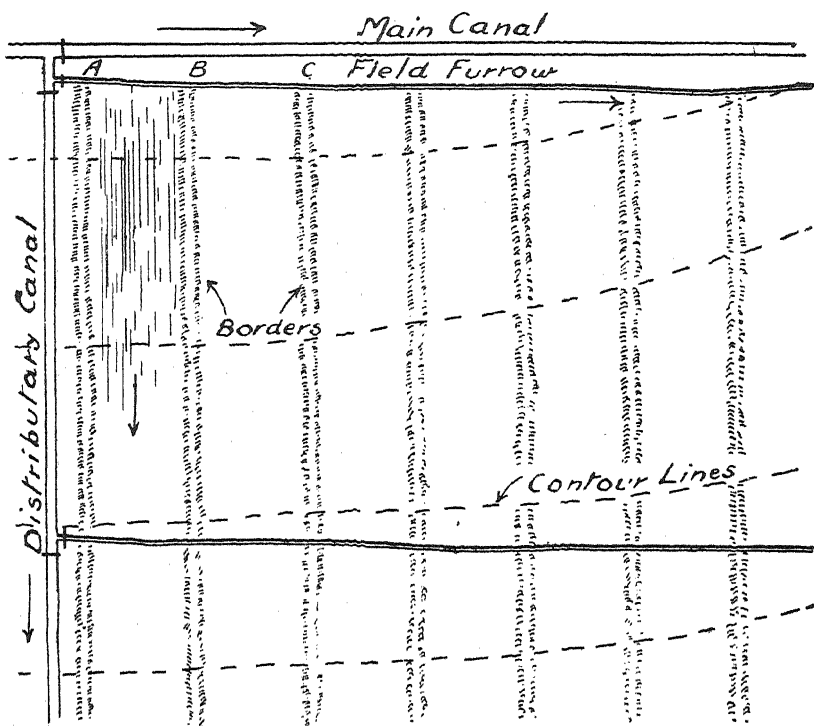


Fig. 5. Flooding between borders.

from the head of the second border and placed at C at the head of the third border, causing the furrow to overflow between the second and third borders, this process being repeated right across the field. Any water flowing off the lower end of a strip is caught up by the lower field furrow which also acts as a drain, but in good practice just sufficient water should be turned into each strip that it will advance to the lower end without waste. Under the best conditions of irrigation there should be no side fall between borders, that is, the strip should be quite flat in a cross-ways direction.

The border dykes should be made broad and low, not exceeding when finished and settled 6 inches high in the centre, and 3 feet wide at the base; this enables reaping machinery and wagons to cross them with advantage. The borders can be constructed by either the scrapers used when levelling the land or by ploughing a back furrow on the location of each border and then going over the back furrow with a ridger. This can be simply constructed on the farm of four 9 inch by 3 inch planks, thoroughly braced as shown in Fig. 6. It is pulled lengthwise along the back furrow strip with the wide spread of the planks in front, drawing a considerable amount of earth from each side to the back furrow in the centre, thus filling the furrow and forming a substantial ridge, which can afterwards be rounded off by gently harrowing. When seeding, the tops of the borders are sown at the same time as the remainder of the field.

This system can be adopted for most crops, conditions of soil and topography, and will be found to simplify and lessen the work of irrigation, and is therefore to be recommended as suitable for most parts of this country. The borders and furrows are of course laid out in such a manner as to become permanent features of the land.

Flooding in Basins.—This method is largely used by the small irrigators in such countries as Egypt, India and China for the irrigation of rice and other cereals, and is most suitable where the ground is very flat. The objections to it are that unless the soil is very retentive and the inlet to the basin has a large discharge, the part of the basin nearest the inlet receives much more water than that more distant therefrom. An advantage of the system, however, is that it diminishes the super-vision during the actual time of irrigation.

A field laid out in this system is shown in Fig. 7, where each separate area or basin is bounded by a low wide ridge about 12 inches high. The size and shape of basins are largely influenced by the slope of the land and supply of water available. For the irrigation of wheat and other cereal crops the larger they are the better, providing the ridge does not become too high to permit of machinery working over same; but in most cases a size of 200 yards by 100 yards would be found suitable. For the irrigation of onions and similar small crops a much lesser size could be adopted.

In the illustration (Fig. 7) the distributary canal parallels the main canal, and the field furrows are led off at convenient intervals through a series of basins. The water is first turned into the upper basins at the outlets A and B, and allowed to flow until the whole basin is covered to a depth of several inches, when the flow is discontinued and turned into the next series, C and D. If the basins are practically level, they receive an even depth of water, but where the land is sloping the lower portion of each basin is covered with a greater depth than the upper.

Furrow System.—*Furrow Irrigation.*—This system is particularly adapted to the irrigation of crops growing in rows, although it can also be applied to others. The water is turned from the field furrows into smaller furrows which run across the field upon a grade, so that when the furrow is running full it will not erode. The furrows can be spaced

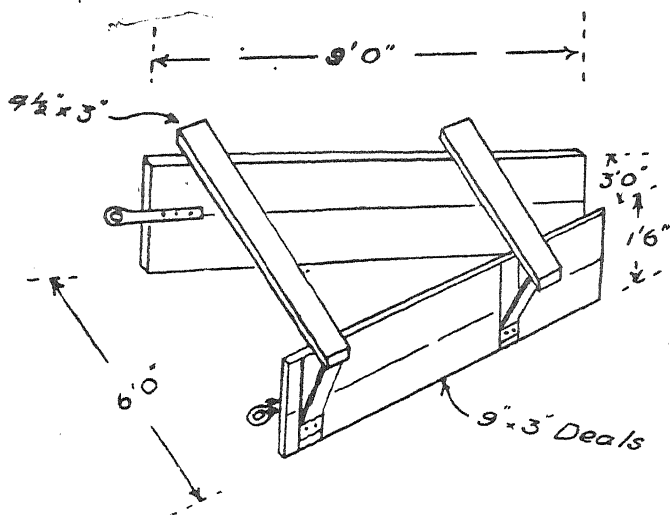


Fig. 6. Ridger.

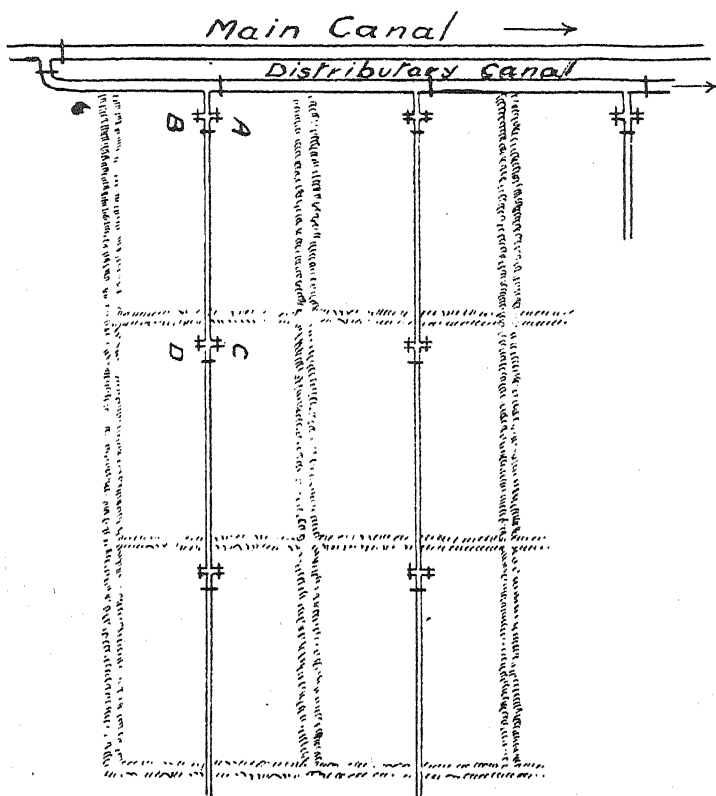


Fig. 7. Basin system of Irrigation.

from 2 to 4 feet apart, depending upon the soil and slope. Where the soil is compact and the slope steep they will be spaced somewhat closer than under the reverse conditions in order to ensure all the ground between the furrows becoming thoroughly wetted. The length of furrows will vary from 200 to 400 feet, and the water is allowed to run in each until the whole length is thoroughly wetted.

Furrow irrigation is very generally used for orchards and citrus groves, a detailed explanation of which was given in an article entitled "Citrus Fruits in Rhodesia," which appeared in the *Rhodesia Agricultural Journal*, June, 1915.

Corrugation Method.—This is a combination of the flooding and furrow systems, and is applicable to non-rowed crops on land of a steep and undulating character. After the surface of the land has been prepared and planted, a light sledge fitted with runners is dragged over the surface to form a series of parallel grooves about 2 feet apart. These grooves or miniature furrows, having a depth of about 6 inches, are run in a direction to obtain a gentle slope so that the water will nicely flow without scouring. The water is run into a series of these grooves, and by their means an even distribution of water is effected.

The two foregoing methods are, where the lands are steep and undulating, more satisfactory than the flooding systems, as the furrows can be located on lines that will secure desirable grades; a thorough wetting of the root systems of the crops is also effected, and, owing to the whole surface of the ground not being wetted, the tendency to baking is largely overcome. It is very necessary, whenever possible, to thoroughly cultivate after each irrigation, and thus check excessive evaporation.

These systems when skilfully used are considered to allow of a more economical application of water, and encourage deeper rooting of crops than with the flooding systems.

General.—Unfortunately many of the farmers in Southern Rhodesia have very little practical knowledge of irrigation, and there appears to be a great scarcity of natives skilled in the art of using water on the land. However, these are matters which, as the country progresses, will right themselves, especially if the right methods are adopted from the commencement. The irrigating head or stream which can be conveniently handled will depend almost entirely upon the skill of the irrigator. On well prepared land a skilful man can deal with a flow of 3 cubic feet per second, but with the raw native labour available here half this amount will be found sufficient if damage to the land is to be prevented. The larger the stream used, within certain limits, the greater the economy in the use of water, but the foregoing limitations will be the deciding factor here for the present.

It is hoped in a further article to discuss the water requirements of crops, the times to irrigate, and the drainage of irrigated land.

The New Tannery.

THE MANUFACTURE OF LEATHER IN RHODESIA.

By R. R. NEEDHAM.

The proposal to establish a tannery in Rhodesia has been received with general approval, judging by journalistic comments and the expressions of opinion received from commercial men, farmers and the like resident in all parts of the country.

Cattle breeding is attracting more attention than that of any other industry, and it appears likely that development during the next few years will establish this industry as the predominant one in Rhodesia. Consequently, the potentiality for the supply of the tanner's raw material looms large in the matter of cattle hides, to which must be added a supply of goat and sheep skins, as also the skins and hides of wild animals, which in many instances should provide very useful leather. There is no need for argument or elaboration on this point. Other considerations centre on the suitability of climatic conditions for producing leather: whether the slaughter of animals designed for export will take place in this country, which, if this initial enterprise succeeds, should make tanning one of Rhodesia's staple industries. In regard to the first point, climate and other natural conditions appear to be entirely favourable, but necessarily no decided views can be expressed until definite knowledge is obtained from an examination of the leather produced. As to the second point, recent discussions at meetings held by the various cattle owners' associations indicate that the prevailing opinion is in favour of exporting dead rather than live meat, and to this end the erection of one or more freezing plants is contemplated. As is generally known, cattle have hitherto been exported either on the hoof or by rail, and consequently this country's supply of raw hides has been limited to those from animals killed for home consumption and from such as have died from natural or accidental causes. It may be a surprise to many to learn that even from these apparently restricted sources Government statistics show that in the year 1919 the total weight of hides and skins exported from Southern Rhodesia amounted to 2,024,303 lbs, and the value to £141,641. The estimated number of hides and skins thus represented is put at 180,000. It is obvious, therefore, that there is ample raw material available in the country to justify the erection of one tannery and reason to anticipate that in the future the industry may be largely extended.

The Rhodesia Leather Co., Ltd., formed under the auspices of the British South Africa Company, is erecting its first tannery on a site adjacent to the Bureau railway siding, some five miles east of Salisbury, and is thus conveniently situated geographically, as it is midway between Bulawayo and the point of despatch for its products overseas, namely, Beira. The situation is also suitable for other reasons, including those of an ample water supply from the Cleveland Dam, the erection of open sheds in lieu of closed-in buildings, and its accessibility to a town where mechanical facilities and stores are obtainable.

The following is a brief description of the buildings and plant. A large shed, 88 feet by 44 feet, is designed to cover the plant required for the operations of liming and tanning. Along the centre lengthwise runs the shafting for driving the plant, consisting of paddle tanks, rockers and other treatment vats, the lime yard being on one side of the shafting, the tan yard on the other. Adjoining is a drying room to which steam can be introduced as required, and a further partially open shed is being erected to which the goods from the tan yard will be taken for the early stages of drying. A brick compound has been erected for the housing of natives, and other buildings will in due course be provided for storage purposes. Power requirements for the time being will not exceed 30 h.p., and to supply this a new type of petrol engine has been introduced from England, and which permits, by slight adjustments, the use of producer gas in lieu of petrol. Steam needed for the hot room, the dissolving of tanning extracts, etc., is obtained from a small boiler.

This initial installation is estimated to deal with 1,000 hides and skins per week, and additional plant can be added without hindering the operations of the existing unit when an enlargement of the output is justified. It is anticipated that by the time this article appears tanning operations will have commenced.

Tanning processes to be employed will be varied, mineral and vegetable tannins both being used; but in this direction much will depend on what is found to be more useful in the light of experience. Incidentally it may be mentioned that mineral tannages, for reasons that space do not permit of detailing, are superseding those where vegetable tannins are employed, and in the course of a few years it is likely that the use of the latter will be very restricted. This may be worth the attention of those who propose planting wattle trees with a view to supplying bark to tanners.

No mention has been made of the use of machines, for the simple reason that at the start no machines, with trifling exceptions, commonly found in a leather manufacturer's finishing shop will be installed. Later on, as the business develops, the equipment for currying and finishing will be added, so as to produce the varied and attractive looking goods to which the eye is accustomed, and it is also hoped an up-to-date boot and shoe factory will be established. The tannery's product in the main will consist of a rough unfinished leather for export, the overseas buyers subjecting the goods to further treatment, varying with the class of leather desired. It is, however, intended at once to meet Rhodesia's needs in certain directions, and chiefly in the matter of sole leather.

It may be stated without offence, because the fact is generally accepted, that the average quality of this leather has deteriorated during the past few years, due mainly to a change in conditions and the introduction of more rapid tanning methods. Other factors, however, have contributed to this falling off in quality, and which may be briefly referred to. The bright even colour and smooth polished surfaces to which much attention is given for the purpose of catching the eyes of the bootmaker and the public cost money, a sacrifice to show rather than utility. It is also the custom, now being departed from in some countries, to sell the leather by weight, and consequently the aim of the tanner is to make the goods as heavy as possible, and it is often carried to an illegitimate extent by the introduction of such filling materials as glucose, Epsom salts or barytes. The substance (thickness) as seen in some sole leathers is entirely disproportionate to the natural substance of the hide, and the materials introduced to secure this have not only no wearing quality, but may hasten the disintegration of the leather itself. Hide fibre is the only wearing constituent of leather, and the product which is free from artificial stuffing is coming more into favour. A well-prepared chrome or pyrotan sole leather has twice the wear of the average vegetable-tanned article, substance being equal. It is intended to supply a sole leather from the Rhodesian Tannery that will possess the long wearing quality referred to combined with other advantages relating to comfort and ease in handling. In addition, it is intended to make leathers that will prove suitable for machinery uses, harness repairs, strops, reims, whips, etc.

Before Rhodesia can reap the full benefit of her resources in hides and skins they must receive the care and treatment necessary for meeting market requirements which is bestowed on any other raw material. Rhodesian hides are in bad repute; they not only possess defects which are common to those of other countries, but damage which can and ought to be removed by the application of some knowledge combined with care and attention in handling. The ready market prevailing during the war period is not likely to recur, nor the high prices, and if Rhodesian hides and leather are to gain a footing in the world's markets, some serious endeavour must be made to provide an acceptable commodity. To put it quite plainly, they are probably less sought after than those of any other country, but this stigma can be removed if only producers will realise that a hide, like maize or mica, has to be prepared with a view to the buyer's requirements. It is purely a matter of £ s. d. If the operations through which the hide passes, commencing with the flaying of the animal to its despatch from the port of shipment, received the attention they should do, it is probable that the market value would be increased by 25 per cent., and the practical importance of this is seen from the following illustration:—The value of exports in 1919 was £141,641, and with the improved treatment methods indicated, the value probably would have been £177,051, causing a loss to the country of £35,410.

To make this article of some practical assistance to butchers, farmers, etc., the following details will doubtless be appreciated:—The operations to which attention is directed are those of branding, flaying,

drying out, and precautions to be observed for keeping sound the grain (hair) side of the hide, storage and kindred matters.

In regard to branding, the farmer has probably very little responsibility in the matter, nevertheless there remains the outstanding fact that branding, as it is pursued, very materially depreciates the value of the hide, and in this respect Rhodesia, compared with other countries, seems to be the worst offender. The marking is invariably placed on the most valuable part of the hide, the space covered by a single brand is excessive, the spoilation is frequently intensified by a multiplication of brands, and, to complete the picture, often both sides of the beast are subjected to the same disfigurement. It is astonishing that the Governments of South Africa not only condone, but help to perpetuate the sacrifice of one of the continent's sources of wealth. Suggestions have been made as to alternative positions for the branding marks, such as the horn or the neck, and the sooner a change from present wasteful methods is adopted the better for the hide and skin industry.

The removal of the hide from the animal, flaying as it is usually termed, is, in the lack of care with which it is carried out, one of the most undesirable features of South African hides. The knife used by the operator too frequently cuts right into the corium of the skin, the material for conversion into leather, and when the adhering flesh is shaved off by the tanner the flesh surface presents a display of numerous scores or cuts. The effect of such cuts is briefly this:—At the point where the cut occurs the leather is necessarily weakened, and its wearing and water-resisting powers at such point or points are obviously less than where no cuts occur. It is an old saying that the strength of a chain lies in its weakest link, and a parallel is found in what is being described; with sole leather, for example, the wearer discovers all too soon that holes appear in the soles of his boots, and, whilst the surrounds may be sound, the repair of the boots becomes a necessity. The boot-maker or repairer in England, with an eye to a reputation, would not admit to his factory or shop sole leather manufactured from South African hides such as can be seen in stores in Rhodesia. In England a hide exhibiting more than three cuts is relegated from first to second selection, a difference in value of from one penny to twopence per pound, and when it is remembered that such a hide has perhaps a weight of 90 lbs., the loss resulting from an extra cut becomes a matter of considerable importance. It is regrettable to remark that South Africa is a far greater offender in this respect than India, China, Java, Burmah, or even Somaliland, although in all instances the flaying operation is carried out by natives. The reason must be attributed to the need for instruction to the native who uses the knife, for there is little doubt but that his work could eventually be made both efficient and rapid if only the requirements were instilled into his mind and haste in the learning stages deprecated. A safety flaying knife is employed in Paris, where its use is made compulsory, its introduction having resulted, so it is said, in an increase of £30,000 per annum in the value of that city's output of hides. Enquiries are being pursued with a view to introducing this knife to Rhodesia. In the packing yards in the United States, instead of flaying with a knife, the hide is stripped or pulled off the

beast after certain incisions with a knife have been made. Such a method obviously precludes damage of the nature referred to, and there seems no reason why it should not be adopted in this country, especially in municipal abattoirs.

The cure and drying out is an operation needing knowledge and care. The two methods commonly in vogue in South Africa are those of sun-drying and dry-salting; the former process is rarely satisfactory, irrespective of the origin of the goods. Unfortunately the term "sun-drying" has become current, a misleading one, for no hide during the dry stage should be exposed to the fierce rays of the sun; invariably it ought to be done in the *shade*, and where there is a good draught of air passing. A sun-dried hide may have the outward appearance of being thoroughly dried, but the tanner too often discovers after it has been soaked and brought to a flaccid condition that putrefaction is present, and for leather-making or any other purpose the hide is useless. Drying, whatever the cure, must be complete internally as well as externally, unless the goods can be quickly transported to the tanner. It is admitted that in remote places the lack of salt, or the high cost of same even when procurable, serves to make shade-drying the only practicable form of cure, but where salt is obtainable at a moderate price dry-salting from all points of view is preferable. Perhaps the cheapest and simplest method of carrying this out is as follows:—First of all, thoroughly drain and partially dry the goods by suspending them in the shade, followed by immersion in a strong brine bath for 24 to 48 hours before final drying out. A more approved method is to give two or more baths in the brine for shorter periods, the goods being hung to drain and partially dried between the baths. Salting can also be done by piling the hides in a cool place, hair side against flesh side, a layer of salt being spread between each pair. In the case of goods intended for the Rhodesian tannery and where the time occupied in transport is likely to occupy a few days only, the green hide, after being thoroughly drained and cleaned, need only receive the slight attention in salting necessary to preserve it during transit. Every precaution must be taken to avoid damage of any kind to the grain (hair) side, for every scratch or cut shows up plainly on the leather and affects its selling price. Needless to remark, much damage is inflicted on the majority of animals in this country before coming into the slaughterer's hands, and it is in the interest of the farmer to exercise every precaution possible to avoid damage to the hide from barbed wire and the like.

After curing and drying, goods intended for export should be stored in a shed free from damp and well ventilated, and protected so far as possible from the attack of ants and other insects. It is advisable to defer baling until the goods are about to be despatched.

The hide, skin and leather markets are in a chaotic condition the world over, and not only has there been a phenomenal fall in values, but demand both for the raw material and finished leathers has correspondingly decreased. There are wild fluctuations in prices even at the lower levels, and a return to stable conditions cannot yet be looked for. With such depreciated values, a market for the better grades of raw

material can alone be anticipated, and it seems fairly certain that a considerable period must elapse before inferior goods will again be in demand. The greater reason, therefore, for an immediate and serious effort to remedy the defects so common to Rhodesian hides and skins and to endeavour to bring our raw material to a par with, if not better than, the product of other countries. To this end it is hoped that the remarks made in this article may prove of service. If further information on any point is desired, the writer will be pleased, to the best of his ability, to reply to any queries addressed to him.

Napier Grass as a Pasture.

Results obtained from grazing a small plot of Napier grass at Wollongbar experiment farm led to an area of two acres being planted last spring for a more extensive trial. The land selected had been previously under Napier grass, but it was well prepared, and on 20th October, 1919, cuttings were planted 3 feet apart in rows that were 4 feet apart. About 60 per cent. of the sets grew, which was considered satisfactory under the dry conditions prevailing; the vacant places were replanted on 25th November.

The growth was good, and on 3rd, 4th and 5th January, 1920, 56 head of milking cows were agisted for five hours each day. Their milk yield had been measured on 2nd January, 96 gallons being recorded, but on the three following days on the Napier grass they gave 108, 113 and 111 gallons, which was equal to over a quart increase per cow per day.

On 19th March 41 head of milkers were again turned in, their 69 gallons of milk on the previous day increasing to 73 gallons in response to the improved fodder.

On 21st May a third trial was made with 12 milking cows, whose yield was increased by half a pint for the day. The weather was cold and the cows were rugged on this occasion, so that good results could not be expected.

A noticeable feature of the trials was the fine growth sent up after the first and subsequent grazings.—*New South Wales Agricultural Gazette*, August, 1920.

The Common Fruit Beetle.

(*PACHNODA IMPRESSA*, GOLD.)

By RUPERT W. JACK, F.E.S., Chief Entomologist.

The dark green and yellow beetle figured in the accompanying plate is well known to all residents in this Territory as an enemy of fruit and blossoms, and occurs throughout South Africa with the exception of the south-western portions of the sub-continent. Nevertheless its life history appears to be unknown elsewhere, and it is largely with the object of placing on record observations in this connection, carried out mainly by Mr. R. Lowe Thompson, late of the entomological branch, that the following short note has been prepared.

Description and Life History.—The adult or beetle stage is so familiar as hardly to need description. The beetles average roughly about four-fifths of an inch in length, the thorax and wing covers being dark olive green and yellow as in the illustration (see fig. 4). The extent of the markings varies to a slight degree. The head is dark olive green at the base, the front portion being reddish brown. The legs are more or less reddish brown in colour and the underside of the body reddish brown with transverse light yellow spots. Occasionally the light markings on the underside are white.

There are quite a number of other species of allied beetles which have more or less similar feeding habits in the adult stage, but *P. impressa* is by far the commonest and therefore most destructive.

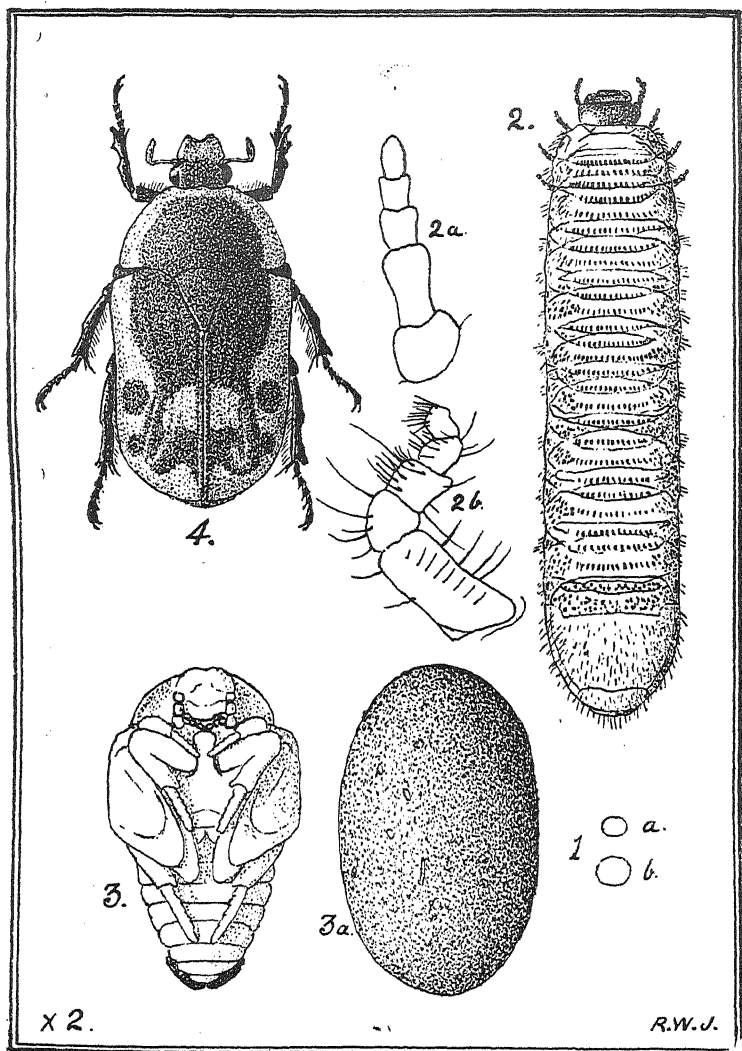
The beetles usually appear on the wing from about the middle of November, and are to be found in decreasing numbers throughout the wet season, very few surviving until April. Our earliest record of egg-laying is 2nd January, but adults have been observed alighting on and burying themselves in kraal manure as early as November. Sixty adults kept in the laboratory, which emerged from the soil between 18th and 30th November, did not lay, however, until January, and another lot collected on 14th November failed to lay until 2nd January.

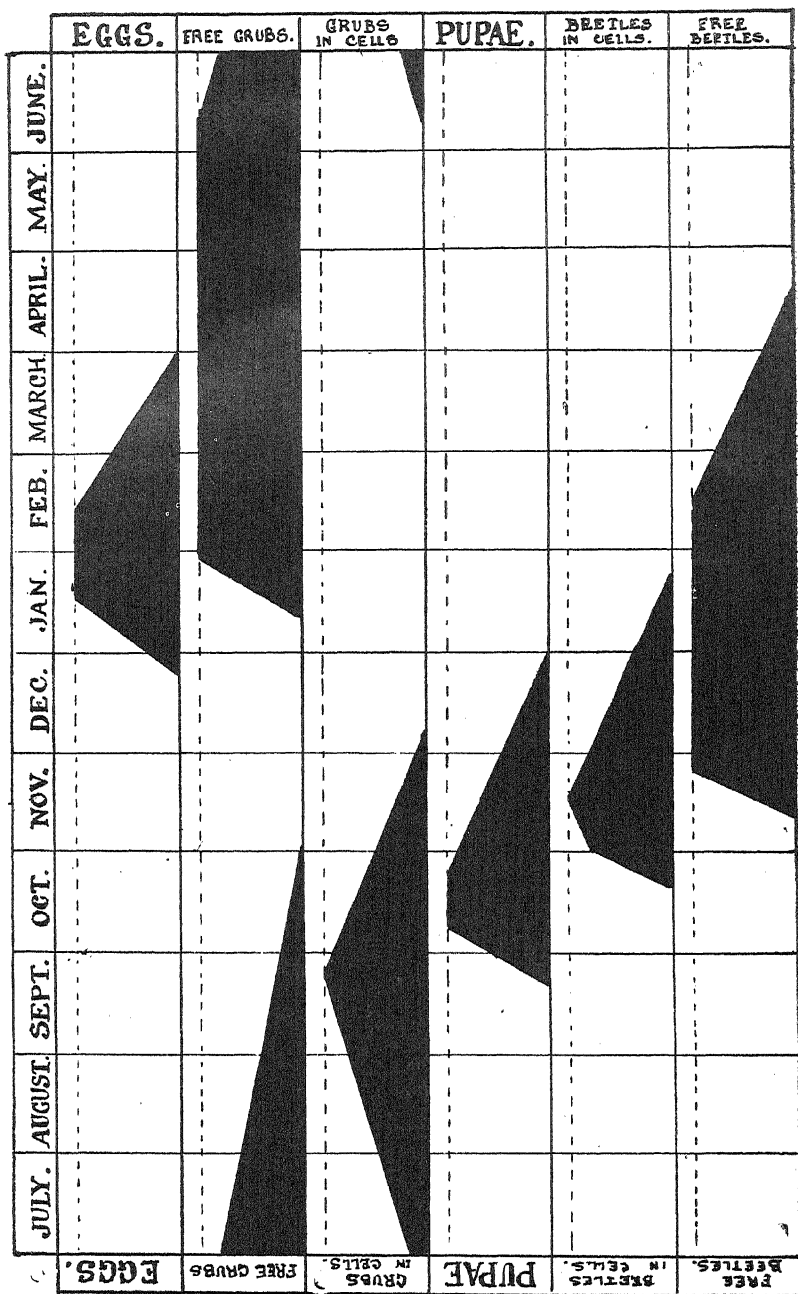
The eggs are laid singly in rotted kraal manure, or soil rich in humus at a depth of about 1 inch from the surface. They are white, and a freshly laid specimen was found to measure 1.86 mm. During

the incubation period, however, they increase in size and become nearly spherical in shape. A specimen near hatching measured 2.34 mm. by 2.20 mm. (see plate, figs. 1a and 1b). The incubation period in observed instances was recorded as 15 to 18 days.

The grubs feed on rotted vegetable matter, including manure, and grow rapidly during the wet season, but the rate of growth varies greatly with individuals. As an instance, three eggs hatched on 16th January and the grubs were kept in the same receptacle. By 26th March these three larvæ were respectively 12, 18 and 28 millimetres in length. In another instance eggs were placed in a dish on 5th January, and 16 larvæ, measuring 10 to 20 millimetres in length, were transferred to a breeding pot on 3rd February. By 15th April one measured 28 millimetres, and by 10th May the grubs measured from 25 to 40 millimetres; 45 millimetres is about the length of a full-grown larva.

The grubs have the peculiarities of other members of the sub-family. The legs are very small compared with the size of the insect and are destitute of claws, being provided instead with numerous strong bristles and spines (see plate, fig. 2b). When the insect is on the surface of the soil they are not used for locomotion at all, the insect invariably progressing *on its back*. In this seemingly awkward position it attains a very respectable speed, the prominent transverse ridges on the back armed with backward projecting spines being of far more use for rapid movement than the legs of most beetle grubs. The duration of the larval period is a little difficult to determine with great accuracy, as the larvæ rest for a considerable time in the pupal cells before pupating. The period also varies greatly with individuals, and although the great majority of the insects pass through their transformations in one year, it is quite possible that a limited number, as in the case of other annual insects, occupy two years in the process. Larvæ from eggs laid in January have constructed pupal cells in August, the adults emerging from these in late November and December. Pupal cells have, however, been found in the field as early as the 9th June, although considerable numbers of active larvæ were also present at this date. The cells contained resting larvæ only. A cell opened on the 9th August contained a resting larva. Between the 24th and 27th of September a thorough search was made of a known breeding ground at Salisbury, with the result that 18 active larvæ were found, 15 inactive (probably jarred out of broken cells), 15 broken cells containing larvæ, 4 broken cells containing pupæ and 4 unbroken cells. The digging was done by a native, hence the damage to the fragile cells. It is obvious, therefore, that pupation was just about commencing at this date, and that the main pupation period must be slightly later, in October. Cells in the breeding cages opened on 23rd October were found to contain pupæ. Three resting larvæ broken out of cells taken 24th October and 27th September, as above, all pupated on the surface by 4th October, and adults (crippled) appeared, two on 29th October and one on 1st November. In broken cells kept under observation adults (pale and soft) were noted the 21st and 22nd October. On 27th October eight adults were noted in cells and four pupæ; the latter had all produced adults by 4th November. On 15th November three adults had left the cells, and others emerged





between that date and 3rd December. The pupal period is thus 25 to 28 days.

As the main emergence of beetles from the ground occurs about the middle of November at Salisbury, the life cycle for this locality appears to be tolerably clear (see diagram). Egg-laying commences at the beginning of January (perhaps rather earlier) and continues at a diminishing rate throughout the wet season. The main brood of grubs feeds from January to June, and then constructs pupal cells, in which the larvæ rest until October. Pupation then occurs, the adults appearing in the cells at the end of October and beginning of November. These leave their cells and the ground apparently after the first soaking rains, about the middle of November. Belated individuals go through these changes somewhat quicker, but the adults from such have always emerged later than the main brood in the cages, some beetles not appearing until January.

As might be expected, the brood is apparently very much earlier in warmer localities than Salisbury. A number of pupal cells were received from the Victoria Falls on 29th August, and adults emerged from these by 9th September. The Victoria Falls is, of course, not only a much warmer locality than Salisbury, but also much moister in the dry season.

It may be mentioned that the pupal cells of this insect are of extremely neat construction. A specimen is figured at twice its natural dimensions on the plate (fig. 3a). The cell is constructed of particles of soil and sand connected together, and is of regular oval form. Average specimens measure about 9-10ths by 3-5ths of an inch. The walls are little more than half a millimetre, i.e., 1-15th of an inch in thickness. These cells have been found in the ground at a depth of 4 to 6 inches.

Feeding Habits.—The common Fruit Beetle feeds, of course, both in the larval and adult stages. The larvæ are very common in the rotted dung of cattle kraals, and it is likely that this is the favourite situation for breeding. Decayed vegetable matter appears to be the main consideration, however, and the bulk of the material collected by Mr. Thompson for breeding purposes was collected in the rich humus under a wood pile in a Salisbury garden. Under entirely natural conditions the insect must breed mainly in collections of leaf mould and other detritus which accumulates in sheltered situations, particularly on the slopes of irregular rocky kopjes and outcrops where tree growth occurs. The cattle kraal and manure heap may probably be regarded as largely responsible for the abundance of these beetles in settled areas.

The adult beetles feed on foliage, blossoms and fruit. Their favourite foliage appears to be that of the grape vine, and they do a considerable amount of damage to these plants. Of various blossoms, they have been noted particularly on roses and other Rosaceous blooms, such as late blooming apples. A vast number were, however, on one occasion observed attacking the yellow bloom of a wild tree (*Acacia* sp.) on the Salisbury commonage in November. As soon as the plums, peaches and apples commence to ripen, however, the destructive nature

of this pest becomes apparent. Fruits may be seen absolutely covered with the beetles, and in bad years they may destroy a very high percentage indeed. This damage continues on through January.

Enemies.—Those inveterate marauders, ants of the genus *Dorylus*, have been observed devouring the larvæ. For this purpose they will apparently break their way into the pupal cells, as they have been observed to do with other beetles. The larvæ are also doubtless subject to the attack of the common carnivorous denizens of their environment, such as large centipedes, scorpions, etc., but no direct observations have been made in this connection.

It is interesting to note that in spite of their bright and apparently "warning" coloration, the beetles are by no means distasteful to insectivorous vertebrates. The writer had at one time a number of tame "night apes" (*Galago* sp.), and no dainty was more appreciated by these little Lemuroids than a handful of *P. impressa* adults thrown into their cage.

Remedial Measures.—Several experiments have been carried out with a view to attracting the beetles to poisoned baits consisting of sugar, molasses and even honey, but with complete lack of success.

The enclosure of choice varieties of trees in mosquito netting is commonly practised in gardens, as this protects the fruit from beetles, fruit piercing moths, birds and other enemies, which combine to cheat the grower of his due, but this is a rather expensive method of protection, particularly at the present period of inflated prices.

As the fruit is rarely attacked by either fruit piercing moths or fruit beetles until it is commencing to ripen, such varieties as will ripen well indoors can be protected in this way.

For the destruction of the beetles manual methods alone promise much success, and fortunately the conditions of comparatively cheap, if inferior, labour in this Territory render the proceeding quite practicable and inexpensive. Large numbers can be collected by jarring them from the trees during the cooler portion of the day into paraffin tins containing a little water with a portion of oil on the surface. Mr. David Gunn of the Division of Entomology in the South African Union has, however, found as a result of a series of experiments that the use of an insect net is more expeditious.* He recommends a net about 18 inches in diameter mounted on a five foot pole. This is held under the infested fruits, and the beetles when disturbed drop into it. From the net they are tipped out into a paraffin tin containing water and oil as above. The net is easily made of a loop of stout wire and cheese cloth. A moderately energetic native trained to use the net can do a very great deal of execution, and Mr. Gunn claims that damage was altogether avoided in certain gardens in Pretoria by this means, although approximately 50 per cent. of early varieties of peaches were destroyed elsewhere. It is to be noted that a net with a loop of wider diameter proved unsatisfactory, as a large number of beetles escaped.

*Bulletin No. 8, 1916, Department of Agriculture, South African Union.

EXPLANATION OF PLATE.

- Fig. 1a. Egg, newly laid, enlarged 2 diameters.
b. Egg, ready to hatch, enlarged 2 diameters.
,, 2. Full-grown larvæ from above, enlarged 2 diameters.
2a. Antenna of larva, much enlarged.
2b. Front leg of larva, much enlarged.
,, 3. Pupa from beneath, enlarged 2 diameters.
3a. Pupal cell, enlarged 2 diameters.
,, 4. Adult, enlarged 2 diameters.
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EXPLANATION OF DIAGRAM.

The diagram aims at conveying at a glance a general idea of the life history of the Fruit Beetle at Salisbury. The blackened areas illustrate the variation in numbers of the different stages of the insect throughout the year, or rather the rise and fall from minimum to maximum occurrence. Thus in June, for instance, the occurrence of eggs, pupæ, beetles in cells and free beetles is at the minimum, *i.e.*, nil. The insect is in fact in its larval or grub stage, the formation of pupal cells in which the grub rests to await pupation commencing about the second in the month. Too much accuracy must not, however, be expected in connection with a diagram of this nature. A great many exceptions invariably occur in the life history of any species of insects, and in any case the steady destruction through natural agencies cannot be accurately indicated. As an instance, if no destruction occurred the grubs should be more numerous in April, May and early June than in February and March, owing to their numbers being increased from late laid eggs, but as a matter of fact owing to the death rate of the larvæ from natural causes the reverse is probably the case. In the diagram, as a compromise the period of maximum occurrence has been extended from February until the formation of pupal cells commences early in June.

Forestry in Rhodesia.

IMPROVEMENT FELLINGS ON THE FARM.

By J. S. HENKEL, Forest Officer.

How to manage the indigenous trees and shrubs on the farm is a question which no doubt puzzles many. Further, where farms have been cut over for mining timber and fuel the problem of what to do with the coppice growth presents points for serious consideration.

In this article it is proposed to place before those interested in the subject some general principles.

In the case of farms newly taken up arable land will be required, or on established farms additional land is required for extension of the area under cultivation. Obviously the best portions of the farm will be selected for the purpose. These good places are usually indicated by the tallest trees and frequently by certain species which are characteristic of good soil. Since cultivation is a necessity there is nothing to say against good cultivation, for the object is to obtain returns of more value than the original crop of trees. On the area selected for arable land and before commencing stubbing operations the tree growth should be studied, and all material likely to be of use on the farm or for purposes of sale specially marked and carefully felled and stored. Most of the local natives will be able to indicate the species of value.

If the stubbing operations are left to natives the usual practice is to cut the trees about two to four feet above the ground. Such a method leads to waste of valuable wood and unnecessary waste of energy in digging out the stumps. A method, by which labour is economised, is to dig all round the base of the tree, severing the main lateral roots one by one, and when this has been done by levering the tree, the tap root and deep going lateral ones are broken off low down. The tree in falling lifts the roots out of the hole and thus renders the removal of the stocks a simpler matter. If the operation of stubbing is done when the soil is wet much labour is saved.

The treatment of indigenous trees growing on the portions of the farm not intended for arable land or paddocks for hay making is a problem beset with difficulties. In not a few cases the trees are looked upon as an encumbrance. They are considered of no value; they interfere with the pasture, and were it not for the expense would be destroyed.

It is the purpose of this article to indicate methods by which considerable improvements can be made on the farm by a judicious system of management. As conditions in the Territory vary considerably in regard to topography, soil and species of trees and shrubs, only general

principles are stated, and it is confidently anticipated that farmers conversant with the conditions on their own farms will have no difficulty in determining a line of policy which will best suit local conditions. The matter is one in which common sense is required.

Except on the eastern border, where woodland and close-type forests are found, the climatic formation over the greater part of Southern Rhodesia is what is technically called "Savannah Forest," and in simple language means a type of forest consisting of scattered trees and shrubs, and between which grass and other herbaceous vegetation is found.

The species of Savannah trees and shrubs vary with elevation, geology, soil and moisture conditions, and for the purposes of this article it is unnecessary to deal with constituent species. All that it is necessary to say is that some species are more widespread than others, and have the capacity to accommodate themselves to varying conditions. Others again have a more local distribution. The height of the dominant trees varies also according to depth of soil and moisture conditions. Where soil and moisture conditions are favourable the trees are tall and have straight boles. In less favourable conditions the trees have short crooked boles with low spreading crowns.

Where conditions are more or less undisturbed the tree growth shows distinct age classes from seedling, coppice or sucker growth a few feet high up to old trees. The sucker or coppice growth where annual fires occur seldom has the opportunity to develop into healthy trees.

As already pointed out, the indigenous tree growth is a climatic one, and it is reasonable to suppose that if Nature's provision is seriously disturbed, man by careless or improvident action may start changes which are not permanently beneficial to the community. He may even give a trend to the climate which may make the Territory uninhabitable for Europeans. That this is so may be seen from the following considerations:—Any kind of vegetation—trees, shrubs, grass and other herbage—tend to hold up water, which, instead of rushing off to the nearest channel and thence to the sea, is absorbed by the subsoil and transpired by the vegetative covering into the atmosphere and falls again as rain. If there is no vegetative covering it is obvious there can be no transpiration.

As is well known many of the dominant trees are deciduous, at least for a short period. The trees flushing into leaf in spring begin to transpire moisture, and the more moisture which is transpired, the nearer will be the saturation point, and even though rain does not fall a less arid atmosphere is produced, in which plants can live and dew be formed. If early spring grass can be induced as a result of heavy dew, the value to the stock industry is incalculable.

Dr. Sim, in his presidential address, section C, on "Causes leading toward Progressive Evolution of the Flora of South Africa" (*South African Journal of Science*, Vol. xvii., November, 1920), aptly says:—"The powerful fly wheel of natural sequence once set in vigorous motion is beyond the power of man to stop, as is evidenced in Northern Africa and in Arabia; but South Africa is still at a stage in which that fly wheel may be started either in the direction of afforestation and grass

protection, leading to upward plant succession accompanied by general vegetative and climatic improvement, or in the direction of veld fires, forest destruction and down grade vegetation reacting on the climate, which again further reacts on the vegetation, until at last the continent is past redemption, as some parts of it now are, and mankind as well as the fauna and flora must die a natural death."

While all this is admitted, the question for solution is how far can a farmer get the best results from his farm and yet not be a contributory factor in bringing about unfavourable climatic conditions.

It is naturally the ambition of everyone on the land to get the best returns. Besides getting the best returns, a no less important object is to increase the value of the property. This article has nothing to do with cereal crops grown on the arable portions of farms, but with the veld. Since stock is kept on most farms, two essential things are required, namely, (1) abundance of good pasturage, and (2) shelter both from the heat of summer and the cold of winter.

A casual inspection of the indigenous tree and shrub growth of the Savannah formation reveals the fact that there is a mixture of many kinds. Here and there are fine specimens of large trees with symmetrical crowns, and scattered amongst them are others in an unhealthy condition with partly dead crowns, and many with crooked and gnarled stems which can never develop into good trees. In other places the trees are too crowded. Scattered amongst the trees there is an understory of shrubs of little value, which take up space that should be occupied by grasses or species of trees of immediate or prospective value.

With such a conglomeration in view, it is no wonder that generally speaking little has been done. But has not the time come to do something? It may be argued that the results to be obtained by any sort of treatment will not be commensurate with the expenditure! The writer is of opinion that they will.

It is suggested that a vigorous campaign of improvement fellings be made. Under this term a variety of operations is included. The operation is a composite one, combining many forestry operations, such as the following:—

Where the crop consists of mature trees, *i.e.*, those no longer growing vigorously, they should be felled and utilised; where the crop is too dense it should be thinned; unsound and injured material of valuable species should be coppiced. Saplings of good or desirable species should be pruned to single stems, and undesirable shrubs or trees destroyed. The whole operation may be summarised by stating that the object is to get rid of all unsound, unhealthy, deteriorating and harmful material, and in its place to get the ground covered with good grass and valuable, sound and vigorously growing trees and shrubs.

In carrying out improvement fellings, the farmer will naturally, as a preliminary step, make himself acquainted with the characters, value and uses of the various trees and shrubs. Trees, even though at present not considered of value, but which in other respects give good shade, should, in the absence of more useful kinds, be liberally distributed over the farm. Generally the farmer should foster those species

which either yield good timber or produce foliage, pods or seeds edible by stock. To commence the improvement fellings it is suggested that the farmer mark off a definite area, and on this select the trees and shrubs which he desires should not be felled and mark them with a lime white wash or white or red paint, and instruct his labour gang to remove all unmarked material. In the case of undesirable shrubs, it is better to dig them out by the roots if complete eradication is desired. In all other cases fell the trees level with the ground, or at most leaving stumps not more than six inches high.

The felled material should be sorted, and that fit for use as wagon or furniture timber, fencing poles, building timber, spars, etc., made use of on the farm or sold. The crowns and material unfit for any of the aforementioned purposes should be used on the farm as fuel. Material too small for fuel should be burned in heaps, care being taken that no trees are injured in the burning operation.

Generally the improvement fellings should be initiated in the neighbourhood of the homestead and extended in ever widening circles. The general scheme will naturally be modified according to individual taste. Here and there groves of unthinned areas will be reserved as cover for game, and a limited number of belts, where nothing is cut, will be reserved as wind screens.

If anyone is sceptical of the result, an experimental clearing on the lines indicated will show that certain very definite advantages will result from the carrying out of improvement fellings.

Improvement fellings will afford useful employment to farm hands when waiting for rain or when it is too wet to get on to the lands. During the winter months days can be spared for the work, even if it is only to collect the fuel required on the farm.

Care should be taken that too much material is not removed. It is better to err on the side of not taking away enough than to go to the other extreme. Improvement fellings on the lines indicated will increase the volume of pasturage, enhance the value of the farm and have no deleterious effect on the climate.

If the same procedure can be put in operation on the native reserves the same good results will be obtained.

There is one other matter already referred to, and that is the extensive areas clear-cut by mining contractors. Generally the same procedure will be adopted, but as there are few large trees the improvement fellings will be confined chiefly to thinning out coppice growth and removing undesirable shrub species. In thinning coppice it is advisable to leave one good shoot on each stool and to prune the stems so that they may develop into good straight boles. Less valuable species dominating more valuable ones should be removed, and the general aim should be to reconstruct original conditions, but with better grown, and, if possible, more profitable trees.

In subsequent articles it is proposed to deal with the management of Savannah forests after improvement fellings have been made, as well as the introduction of useful exotic trees to supplement the indigenous trees either in the form of breakwinds or plots of trees grown for timber.

Prevention of Disease among Poultry.

By A. LITTLE, Poultry Expert.

All diseases of stock are preventable, and none more easily than those of poultry. To the lay mind this may seem a rash assertion, and perhaps especially so to the ordinary poultry keeper, who as a rule seems to think that fowls are naturally subject to disease, and quite expects them to be so; in fact the so-called hospital is one of the first things to which his ideas turn on commencing poultry keeping. Many are also deterred from keeping poultry, being as they are imbued with the idea that all fowls are at one time or another suffering from disease of some kind. Nothing could be more erroneous. The health or otherwise of poultry depends not upon themselves, but upon those who are supposed to be looking after them.

Disease is almost invariably caused by lack of attention and proper knowledge of measures necessary to keep poultry in good health, as well as from ignorance on the part of the owners of the requirements of their birds. Again, health or disease is transmitted from one generation to another, and this again is the fault of the owner. It is possible to practically stamp out disease, and in fowls, where we *can* have two generations a year, it is more easy of accomplishment than in most stock. The fowl whose vitality is lowered is much more susceptible to any disease inherent in it, or to infection by any disease in its vicinity, than one whose vitality is at the highest pitch. For instance, take the bird whose parents or grandparents have suffered from tuberculosis; it has in its system the tubercular bacilli, and these, as long as the bird is kept in good health, are latent and are kept in check by the phagocytes, which are the health-giving microbes present in all animals and human beings, but if the vitality of this bird is allowed to become below par by reason of wrong treatment, in feeding, etc., or by dirty surroundings, or by housing in stuffy, draughty or in any way unhygienic houses, the phagocytes are weakened, and the disease germ (in this instance the tubercle bacillus) immediately overpowers them. The fowl then becomes ill, and if it is an infectious or contagious disease, the bird in its vicinity, which may not necessarily have this particular disease germ latent in its system, but whose vitality may be lowered, immediately contracts the disease, which rapidly spreads. Each bird which is affected and cured has in it the seeds of the disease, and will transmit it to all its progeny. This is the reason why we have disease among fowls to such an extent. How often do we find the vitality of fowls lowered by dirty food, indigestible food; food of too starchy and fattening a nature (the over-fatty condition of a fowl is one of the *most* common reasons

for lowered vitality and disease), too little exercise, dirty water and often no water at all for hours together and on hot blazing days, lack of grit and charcoal, dirty houses, dirty runs, unventilated, stuffy or draughty and damp houses, birds soaked through with the rain and allowed to go to roost in this condition. All these are causes of lowered vitality, producing susceptibility to disease. The remedy is obvious.

Another very frequent cause of disease is the too common practice of breeding from a fowl which has been cured of disease, and so perpetuating the disease fifty, perhaps a hundred fold, for every chick hatched and reared from such a bird is liable at any time of its life, if its vitality is lowered, to develop the same disease. How often do we find a poultry keeper wasting time and money treating a sick bird and attempting to cure it of an infectious disease. As previously mentioned it is time and money wasted, and if the cure is effected the bird is absolutely useless no matter how valuable as a future breeder. If a female its only future value is as a layer of eggs for eating, if a male it is of no value whatsoever.

It does not take long to produce a flock of birds as hard as nails and practically disease proof; this has already been done in Rhodesia by a large poultry keeper, who when he started four years ago adopted these methods. For the first two or three years every adult bird or chicken which showed the slightest sign of disease or even weakness was destroyed. The treatment may seem drastic, but it pays, and it has paid him well, for he has now a flock of over 700 adults, and reared last season over 1,600 chicks *each one of which* was absolutely strong and healthy. Here we have an example of the stamping out of disease, and that comparatively rapidly.

How to Prevent Disease.—Keep the birds in good health and vitality by giving them proper treatment, *i.e.* :—

- never overfeed;
- give good plain food;
- never allow the birds to become fat; make them take plenty of scratching exercise;
- give plenty of green food;
- give as much thick separated milk as the birds will take;
- always have before them abundance of clean cool fresh water;
- always see that they have abundance of grit and charcoal of a suitable size constantly before them;
- give them clean, well ventilated, but not draughty houses to live in;
- see that the houses are rain-proof, never damp, and admit the sun's rays into all parts.
- keep the birds free from insects by occasional dipping;
- also spray the houses occasionally, and so keep them free from insects;
- never waste time and money in attempting to cure a sick bird, but kill it and burn the carcase;
- never breed except from the healthiest, strongest and most vigorous birds;

never under any circumstances breed from a bird that has been ill and been cured;
hatch well and rear the chicks well, and never allow them to have any set-backs:
exercise every care when buying fresh stock, examine it very carefully, and dip every new bird; isolate it for a week and dip again before putting it with your own stock.

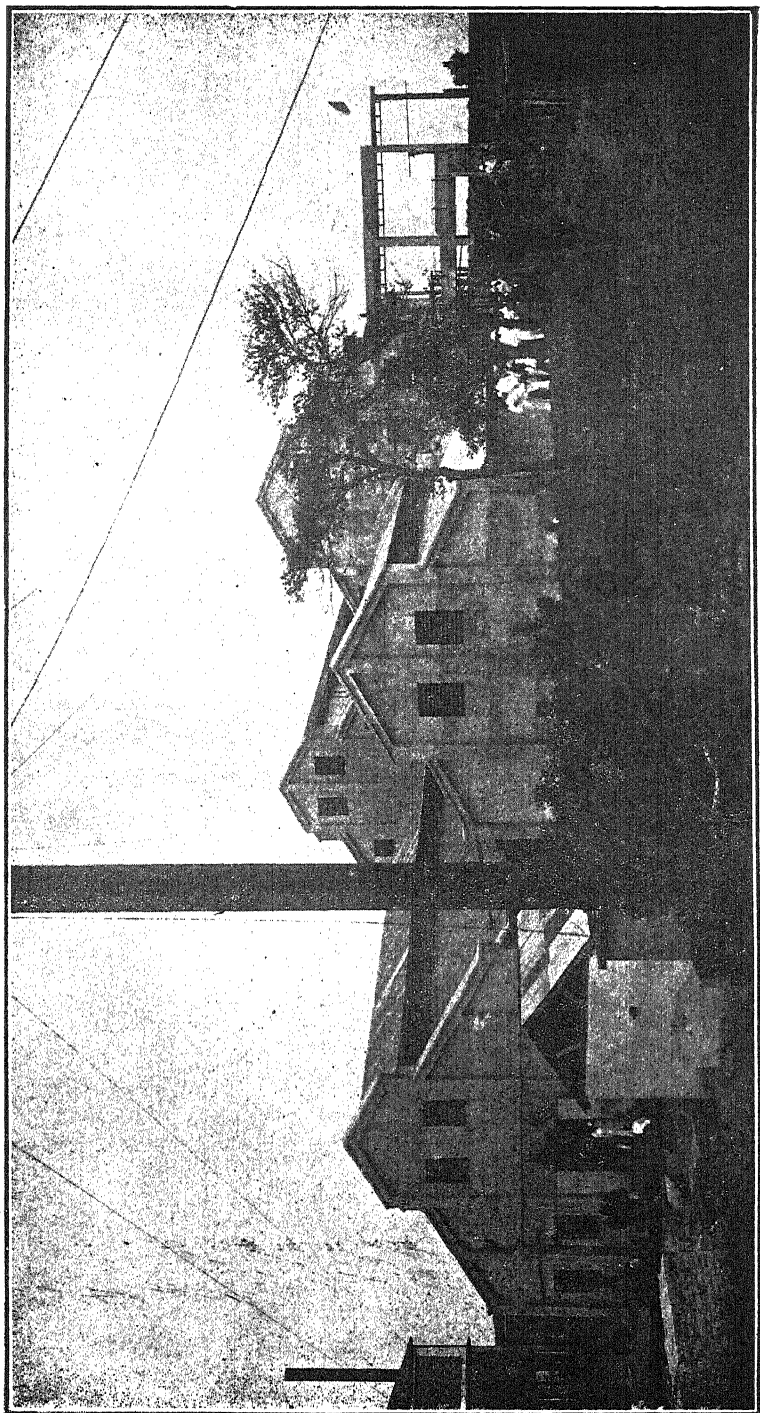
If you follow these methods, you will very soon have a perfectly healthy and very profitable flock of fowls, and one of which you can be justly proud. Further, if every poultry keeper in the country would do this, and it can be done both easily and quickly, we should in time practically stamp poultry diseases out of the country, and produce a large and very profitable industry.

Smithfield Cold Storage & Export Co.

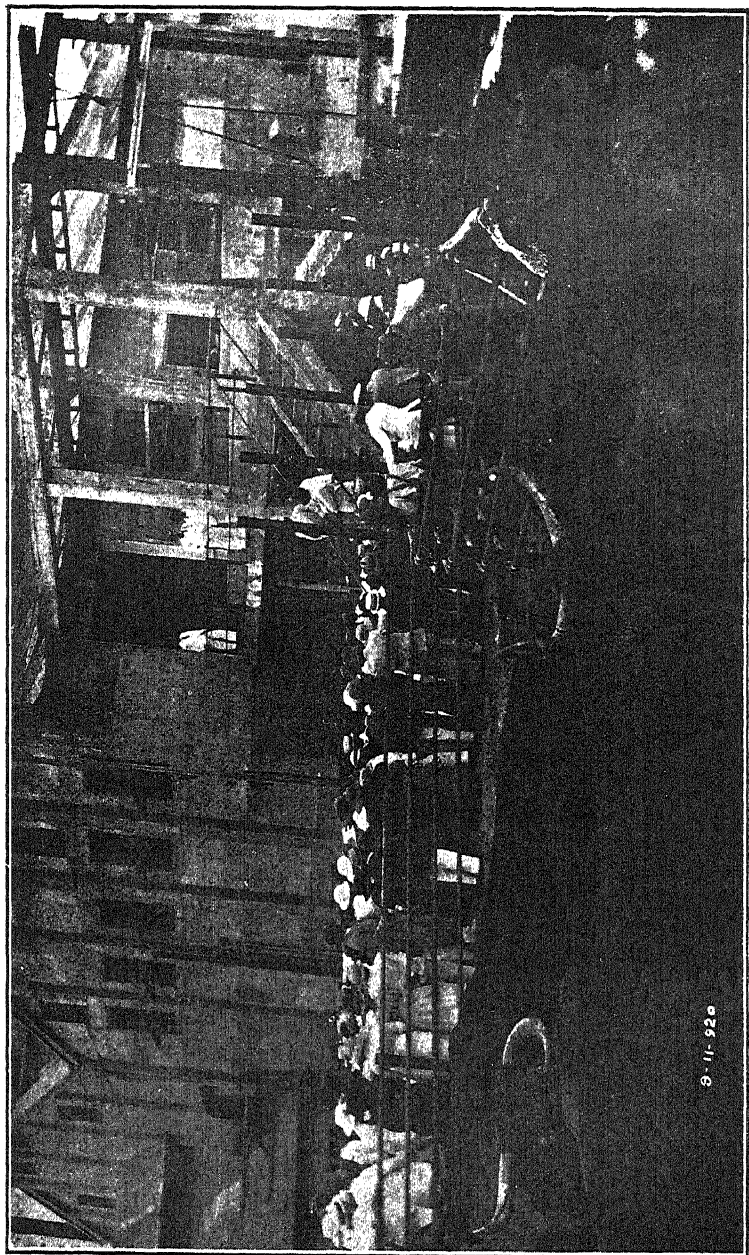
We reproduce two photographs of the works of the Smithfield Cold Storage and Export Co. at Lourenço Marques, which were recently opened for active business. It will be remembered that the Directors of this company toured this Territory recently and held meetings at all the principal centres.

The works have a capacity for 100,000 quarters of beef, besides large accommodation for butter, eggs, poultry, citrus fruits, etc. There are 250 tons of refrigerating machinery installed, and the whole establishment has been rated upon the most modern economic, time and labour saving process.

The photographs give an interesting impression of the scale of the works, though they cannot fully indicate the large size of the factory.



Part view of the Cold Storage Works, Lourenço Marques, Owned by The Smithfield Cold Storage and Export Co. of S.A., Ltd.



3-11-92

Cold Storage and Ice Works, Lourenço Marques.
Cold Storage and Export Co. of S.A., Ltd.
Property of The Smithfield
The opening ceremony.

Kudzu Vine.

(*PUERARIA THUNBERGIANA.*)

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

The Kudzu Vine is one of the latest and most promising crops introduced to the notice of the farming world. A native of Japan, it is there used for pasturage and hay; starch is extracted from the roots and fibre from the stems, and rough rocky land too steep for cultivation is frequently planted to it for grazing. Although known in America for a number of years, it is only of late that Kudzu has come to be appreciated there as a farm crop. It was first introduced to the Salisbury experiment station in 1918, and the plot then established is now one of the features of the station.

Description.—Kudzu is a perennial legume, and is rightly named a vine by reason of the strong climbing or creeping runners which it throws out. In general appearance it resembles the velvet bean, but the leaves are somewhat larger, and the vines, which may reach a length of ten to twenty feet, and the leaf stalks, are hairy. The flowers are purple and the seed pods densely hairy. The plant is deep rooting. The spreading runners root at the nodes. The main tap root is of considerable size, and is the source from which in Japan starch is obtained. These latter characteristics enable it to withstand drought to a marked extent, and in this country it has proved remarkable for its ability to put on a strong growth of foliage immediately the temperature begins to rise in spring and before any rain falls. In this respect it resembles many of our native legumes.

With the advent of winter frosts the foliage is cut back, and the plant makes little or no growth from mid-April to mid-August. For the remaining eight months of the year, however, it has covered the ground with a dense mass of luxuriant vegetation, which, if not provided with any support, will reach a maximum height of two to three feet, in this respect again resembling the velvet bean.

The appended analysis of Kudzu vine forage grown on the experiment station, and made by the Agricultural Chemists of the Department of Agriculture, shows it to be of high feeding value, and to compare very favourably with analyses of South African grown lucerne, cowpea and velvet bean hay:—

	Kudzu Vine.		Lucerne	Cowpea	Velvet bean
	Sample as	Air	hay.	hay.	hay.
	taken.	dried.			
	per cent.	per cent.	per cent.	per cent.	per cent.
Water	80.97	9.24	8.0	8.2	9.3
Fat	0.38	1.84	2.3	2.4	2.6
Protein	3.42	16.30	15.5	13.2	13.3
Carbohydrates ...	6.53	31.10	30.5	39.4	39.4
Fibre	6.68	31.87	34.8	30.5	27.6
Ash	2.02	9.65	8.9	6.3	7.8
	100.0	100.0	100.0	100.0	100.0

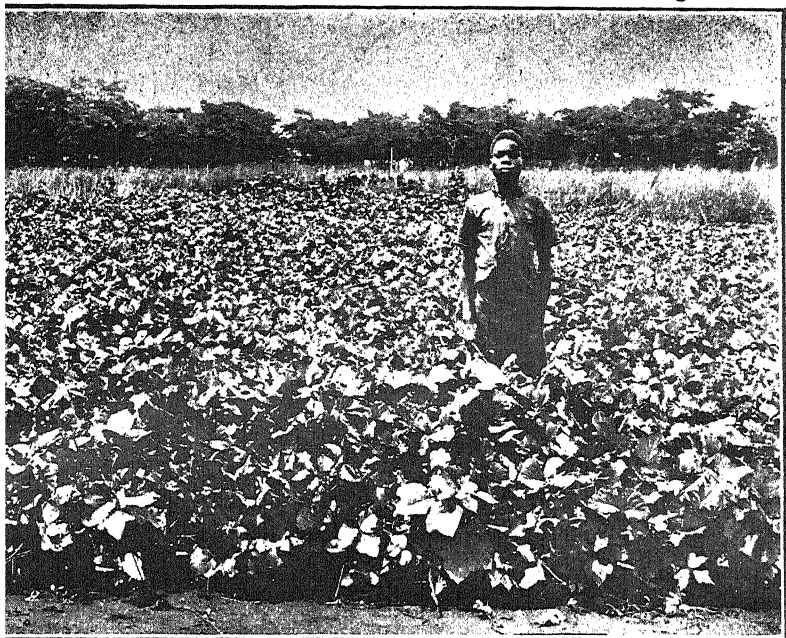
The following extract taken from a recent number of the *Scientific American Supplement* is of interest, and affords some idea of what is thought of Kudzu vine in America. This paper has a world-wide reputation, and while the accuracy of the statement cannot be vouched for here, it probably represents the facts correctly :—

"Kudzu makes a beautiful growth, the leaves being a dark green, and produces a dense growth providing a splendid shade. The plant, however, has another virtue and one that should place it ahead of any other climber to-day. That virtue lies in its value as a food for stock. It is richer in protein than lucerne, and animals thrive on it. Although perennial, the vines should be cut down to the ground each autumn at the approach of winter. The heavy growth of even one vine will sometimes make more than one wagon load of good hay.

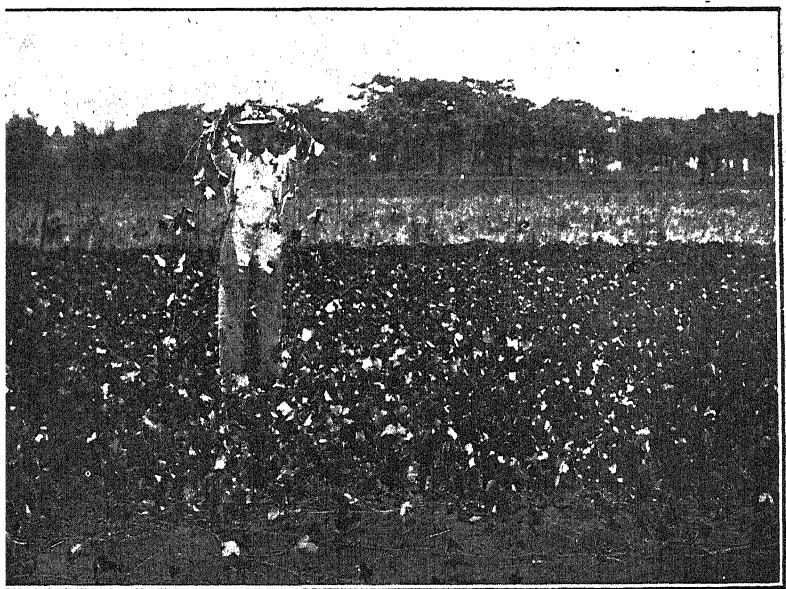
"In America Kudzu is worth from 20 dollars per ton up, making the produce of an acre yield 200 dollars or over. Kudzu is really a pea vine that springs up from the roots when the first warm days come in the spring of the year and grows vigorously until a killing frost comes in the autumn. This gives a growing season in some States of at least eight months in the year, during which several cuttings of hay can be made.

"Instances are known in which four cuttings of hay, averaging ten tons per acre, in a single season have been made. The hay is of the highest quality, being equal to cowpeas or lucerne and much richer than timothy. Another remarkable feature is that although the hay is as rich a food as lucerne, it is entirely free from the tendency to cause loose bowels and bloat in horses and other live stock which interferes so seriously with the use of lucerne.

"According to a number of authorities, Kudzu is of even greater value for grazing purposes than for hay, since it requires no cultivation after the first season, and will thrive upon land that is too poor and rough for any other crop. Naturally, Kudzu will make a stronger growth on rich land, but it does well on land that is too poor for hay crops, and moreover, rapidly improves the soil by adding nitrogen by means of the bacteria on its roots. In this respect it has the same quality as cowpeas, lucerne and other leguminous crops."



No. 1. Kudzu vine, Experiment Station, Salisbury, 11th February, 1920.



No. 2. Kudzu vine, Experiment Station, Salisbury, 18th October, 1920;
new growth made in spring and prior to the start of the rains.

On 30th September young vines of the current season's growth were "layered" in tins on the parent plot, and on 25th October several had a conspicuous swelling at the node, from which rootlets two or three inches long had grown.

From experience so far gained, it appears that if it is desired to transplant Kudzu from the open ground, the operation is best performed early in spring before new growth starts, taking care not to injure the roots and watering until the plants are established.

Under field conditions the simplest method is to "layer" in tins at the beginning of the wet season vines of the current season's growth, so that when the young plants have rooted they may be transferred to permanent quarters during showery weather, and so become well established before the dry season arrives.

The method of layering employed is to place a prepared tin of soil near the parent plant, and by bending the vine to and fro across the tin each node may be embedded an inch or two below the surface of the soil. In this way a number of young plants may be rooted in each tin from one or more vines—the vines later being severed from the parent plant. It is preferable to allow the leaf blades and internodes to remain above the surface of the soil, which should be kept moist but not too wet. In the field new vines readily form roots if pegged down to the soil during the summer, and thus produce new plants.

Results in Rhodesia.—Mr. F. Eyles, Statistician to this Department, was probably the first grower of Kudzu vine in Rhodesia. Somewhere about the year 1913 he introduced it and grew it on his farm in Mazoe, later bringing a few plants into town to grow as creepers and donating one of these to the experiment station. Kudzu seed imported by the Department reached Salisbury early in January of 1918, and was sown the same month in the existing Kudzu plot. Of this seed some 10 per cent. germinated, and in July of the same year about a dozen plants were established. During the wet season of 1918-19 these plants spread rapidly and the runners were regularly layered down, with the result that by January, 1920, the whole plot—some half acre in area—was completely covered with a dense mass of vegetation. On 21st January the new growth of vines averaged 21 feet in length, with an average of eighteen vines to a plant. The distance between the nodes was 8 inches, and the average height of the leaves from the ground 18 inches. Up to this time no yields had been taken, but it was noticeable that few if any weeds were able to hold their own against the smothering effect of Kudzu. In February, 1920, a portion of the plot was cut for hay, and the following yields were recorded:—

Green weight per acre 6,200 lbs.

Weight of hay per acre 2,800 lbs.

Cutting was delayed until late in February in order to secure favourable weather conditions for curing. After this cutting had been taken a good second growth was made, and had the first been made earlier in the season two cuttings would have been obtainable. As it was, a month after cutting the plot would have afforded a very considerable amount of excellent grazing.

It would seem that owing to its very early spring growth Kudzu will usually be ready for cutting for hay by the end of January or early February. If required for hay, therefore, and in order to retard it until more favourable weather conditions for hay making can be expected, it will probably be well to cut or graze the crop from the end of September until towards the end of November, a season when feed of this character is invaluable. It must be remembered also that all growth is cut down by the first severe frost, and whatever method is followed the crop should be utilised before this date.

Uses of Kudzu.—As regards the uses to which Kudzu vine can be put, Rhodesian experience bears out reports from the United States of America. The green fodder can be converted into a palatable if somewhat coarse hay, though, owing to the matted tangle of vine, it seems likely to be a difficult crop to cut with machinery. Its main value, however, is likely to be as a grazing crop and soil enricher. When well established on suitable soil it will undoubtedly afford excellent pasturage at a time of year when this is generally most needed, namely, September and October. The green fodder has no unpleasant taste or smell, and has been freely eaten by cattle and sheep. It would also seem particularly well suited for laying down in pig paddocks for grazing when well established. In this case not only would the pigs feed on the vines and foliage, but they would also probably obtain a comparatively well balanced ration by the addition of the starchy food contained in the tubers. To what extent Kudzu will survive heavy grazing by pigs remains to be seen. Probably they could be used to eradicate the crop when required.

Its qualities as a soil enricher are yet to be demonstrated, and experiments are in hand to test this during the present season. Should its claim to grow well upon poor hillside land be upheld, and should it succeed on the sand veld areas, there seems no limit to the benefit which its introduction may confer.

The present season's supply of rooted plants is already all issued or applied for, but a further quantity will be available next December. Seed can be purchased in South Africa, and farmers desirous of experimenting with the crop may expect to be able to raise somewhere about 10 per cent. of plants if the seed is carefully sown in tins.

Conclusions.—(1) Kudzu vine is an extremely promising perennial legume.

(2) It is difficult to establish from runners unless these are previously well rooted. Imported seed suffers from impaired germination.

(3) In laying out a new field strongly rooted plants should be used and may be spaced about 10 feet apart each way.

(4) Kudzu is at first slow to cover the ground, and will not usually be fully established until the third season after planting.

(5) It makes an extremely early spring growth, and is thus particularly suitable for grazing at this period of the year.

(6) It gives a heavy yield of nutritious fodder which appears palatable either green or dry to all classes of stock.

(7) It produces root nodules freely, and this fact, coupled with the amount of decaying vegetable matter left on the land after the crop is reaped, should render it an excellent soil renovator.

(8) Owing to its deep rooting habit it will probably require a well drained soil, but when once established on the farm under favourable conditions, it is deserving of trial on all classes of soil.

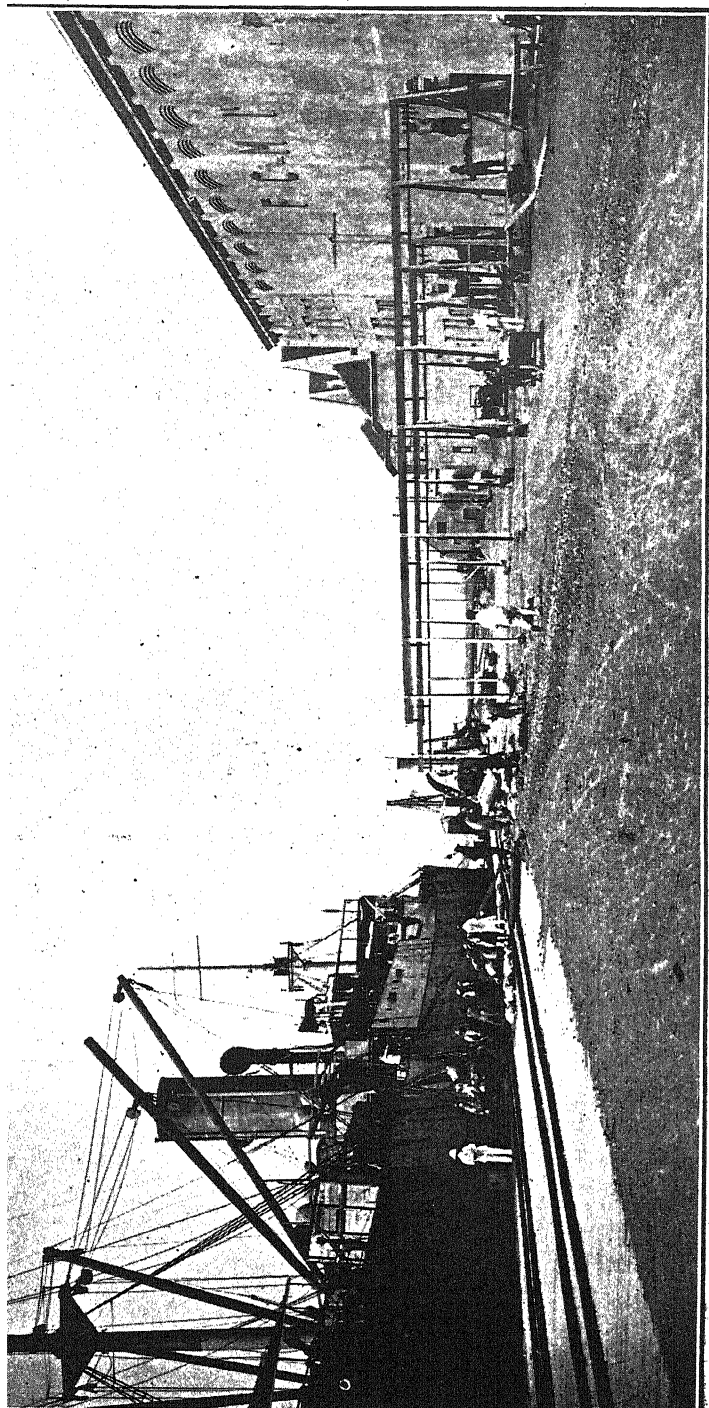
(9) Although Kudzu is said to prefer a clay soil, a special effort should be made to establish it on granite area farms with the primary object of grazing and soil improvement.

(10) Kudzu may prove difficult to entirely eradicate from arable land the first year such land is needed for other crops, but even so, its limited presence is likely to be more beneficial than otherwise.

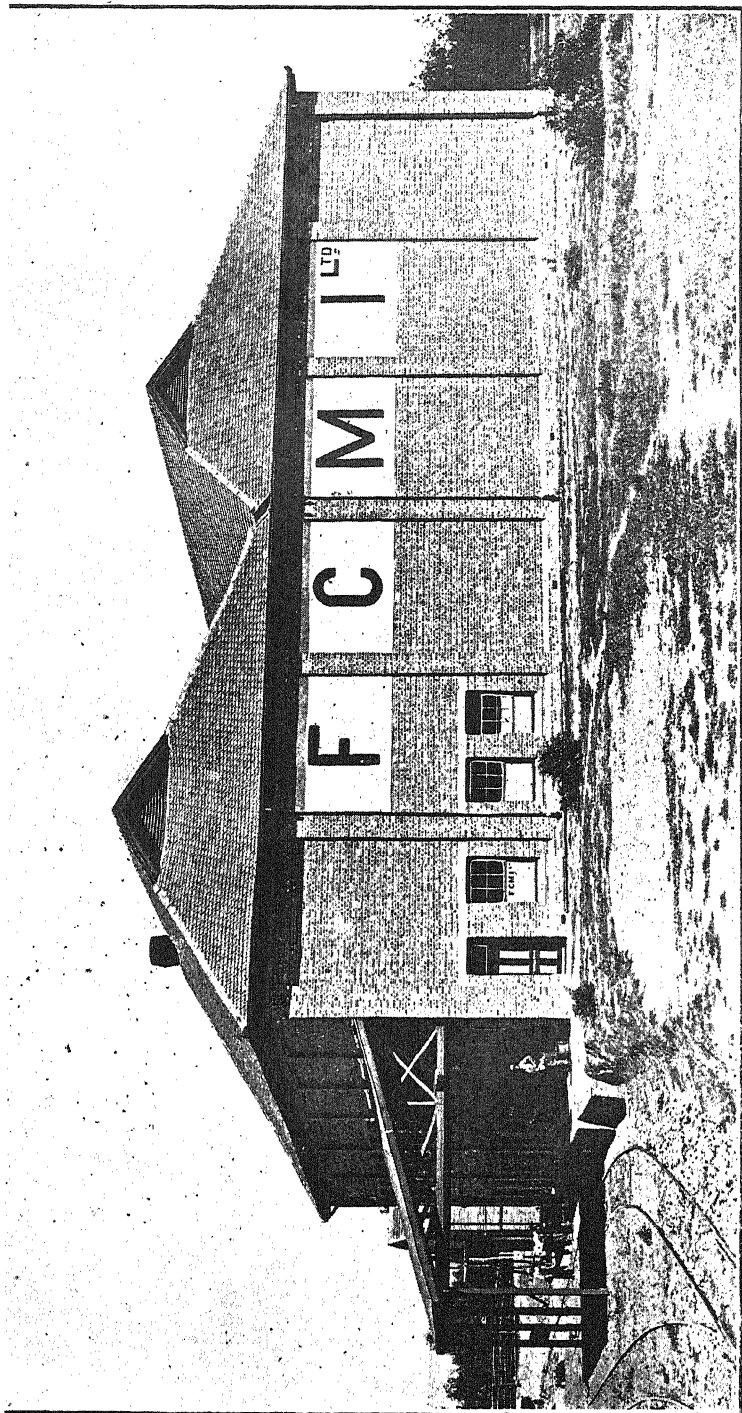
Farmers' Co-operative Meat Industries, Limited.

The photographs reproduced are of the Farmers' Co-operative Meat Industries Cold Storage Works at Congella, Durban, from where the bulk of the beef so far exported from South Africa has been shipped. These works provide storage for 50,000 quarters of beef, and are so constructed that meat is loaded direct from storage into the chilled holds of ships at the wharf alongside.

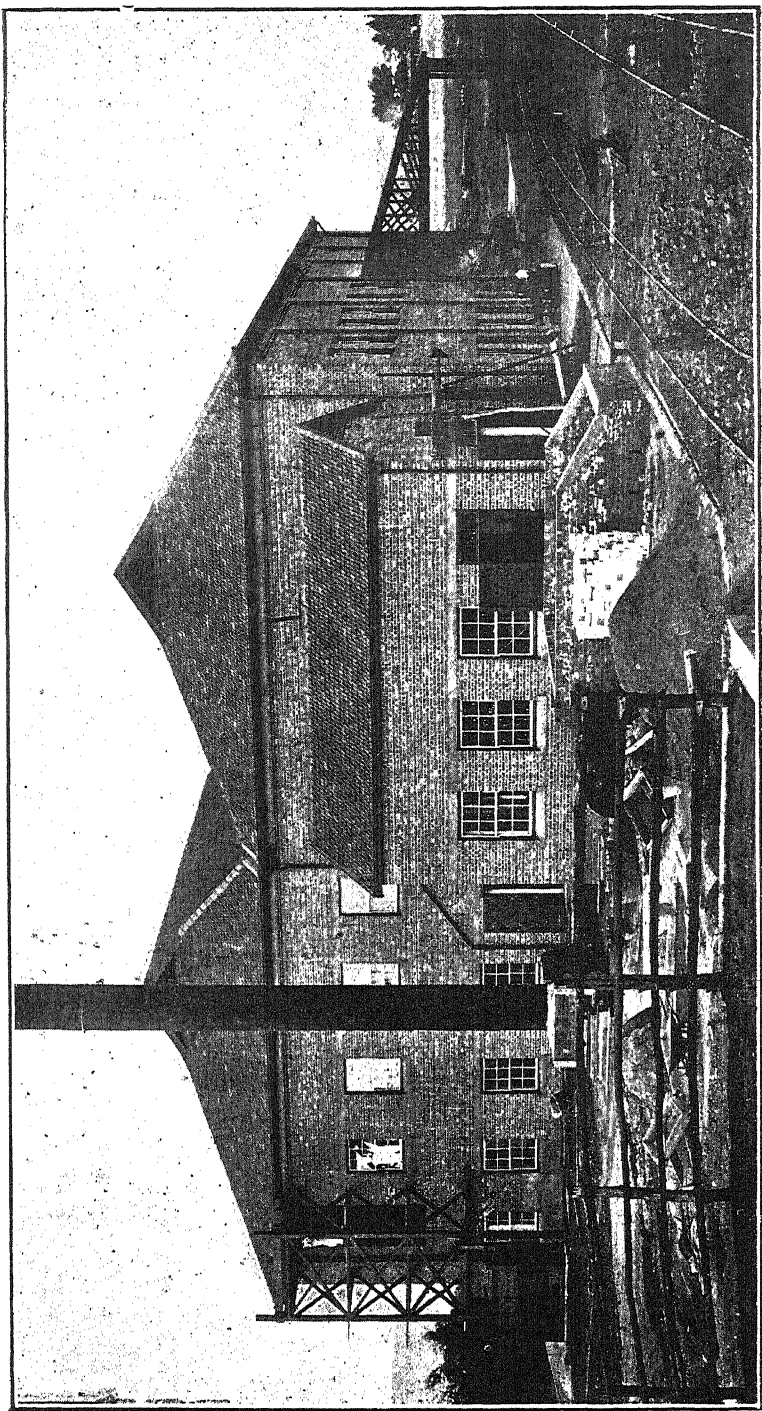
The F.C.M.I. have other works at Maritzburg and Harrismith, and they are also erecting freezing works at Klerksdorp and East London.



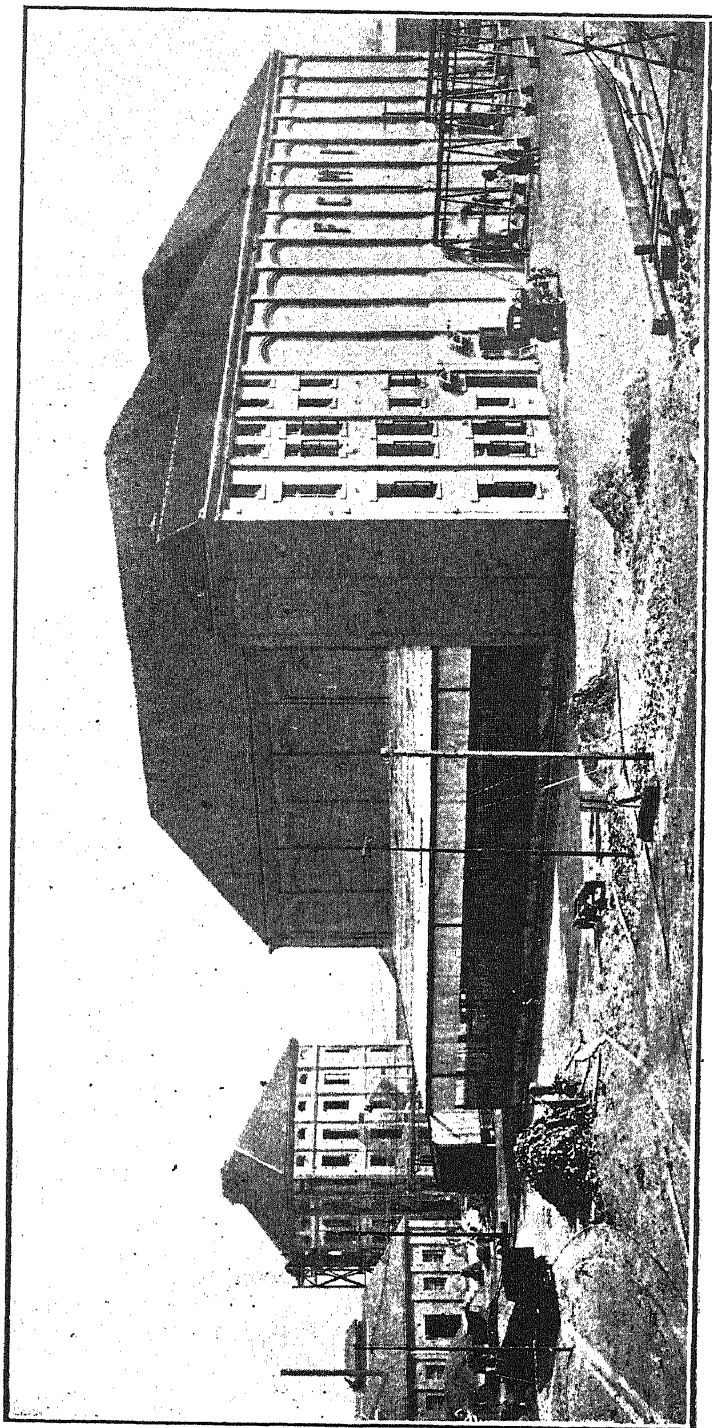
Farmers' Co-operative Meat Industries, Ltd. Loading meat from cold storage direct into ship at Congella wharf. Note conveyor,



Farmers' Co-operative Meat Industries, Ltd. New works at Harrismith,
Orange Free State.



Farmers' Co-operative Meat Industries, Ltd., New works at Harrismith, Orange Free State.



Farmers' Co-operative Meat Industries, Ltd. General view of new works at
Congella, Durban,

The First Annual Southern Rhodesia Egg-Laying Test.

21ST APRIL, 1920, TO 2ND MARCH, 1921.

FIVE BIRDS IN EACH PEN.

Report for week ending 11th January, 1921 (38 weeks).

Eighty-one birds were laying during the week, and produced 338 eggs, an average per laying bird of 4.17, or for the 98 now on the test an average of 3.44.

There were 289 eggs each weighing 2 oz. and over, and 49 weighing less than 2 oz. The total weight of eggs laid was 44 lbs. 7 1-16 oz. (38 lbs. 14 7-16 oz. weight of eggs each 2 oz. and over, and 5 lbs. 8 10-16 oz. weight of eggs under 2 oz.).

The maximum number laid on one day was 56, on the 3rd and 8th, and the minimum 40, on the 9th, an average per day of 43.28 eggs.

Pen 16 laid 25 eggs during the week.

Pen 4 laid 24 eggs during the week.

Pen 13 laid 23 eggs during the week.

Pen 11 laid 21 eggs during the week.

Pens 2, 5 and 12 each laid 20 eggs during the week.

Two birds each laid 7 eggs during the week.

Eight birds each laid 6 eggs during the week.

Twenty-two birds each laid 5 eggs during the week.

Twenty-one birds each laid 4 eggs during the week.

Hen 89 (pen 18) has been returned to her pen cured of broodiness.

Hen 51 (pen 11) became broody on the 8th, but has not yet been cured.

Hen 12 (pen 3) became broody on the 9th, but has not yet been cured.

Hens 88 and 90 (pen 18) became broody on the 10th, but have not yet been cured.

One bird died during the month, viz., No. 38, pen 8. This bird was found dead in its house on the morning of the 9th, although it had shown no signs of illness previously. *Post-mortem* examination showed that death was due to rupture of the liver and intestinal hæmorrhage, following fatty degeneration of the liver, which is not uncommon in poultry; the tissues of the liver break down, and the rupture may be

caused under these conditions by jumping on or off the perch or other sudden jarring movement. All the other birds are in good health.

The week has been very wet, and the birds during nearly the whole of it have perforce been kept in their houses; a sudden change which has necessarily lowered the output of eggs.

HINTS TO BREEDERS.

Householders, clubs, hotels, etc., are complaining of the dearth of table poultry; there are any number of table birds running about, if poultry keepers would only make up their minds to get rid of them. I allude to the number of young cockerels and unprofitable birds one sees everywhere. No cockerels except those which are of the very best should be kept a day longer than necessary; they should be killed for home consumption or disposed of for the same purpose as soon as possible. The cockerels that should be sold for killing are those that are long in shank and thigh, that are narrow backed, and whose backs slope away on each side from the backbone, and those whose combs fall over to one side or other, denoting weak constitution; birds that are pale in face and show hollowing in front and under the eyes (the strongest birds always have a full red face); those that show lack of depth from the back down to the keel; those with a long flat lean looking head; those that are listless, lazy and do not stand up for themselves. *All*, without exception, with these faults should be disposed of at once; *it pays to do so* at almost any price. As for the cross-bred cockerels one sees everywhere, these are quite as unprofitable as breeders, no matter how strong and healthy they are, as the weak constitutioned pure-bred ones. I would urge every poultry keeper to get rid of such superfluous birds, and now especially when the demand is so good; at *no* season of the year, and especially at this time when a number of young cockerels are growing up, should it be said that poultry for killing is unobtainable. The farmer and the big breeder should, previous to the rearing season, have made contracts with hotels, boarding houses, clubs, etc., to supply a certain number each week. I know one who during his rearing season, when he is continually grading off his poorest, sends 50 a week to a hotel; it pays him and it pays the hotel, which is noted for its young tender poultry, a reputation every hotel in the country should strive to merit. Cull severely, and never keep a cockerel of whose qualities you are even doubtful.

21ST APRIL, 1920, TO 2ND MARCH, 1921.—FIVE BIRDS IN EACH PEN.

Pen.	Position to date.	Owner.	Residence.	Breed.	21st April to 11th January, inclusive (38 weeks).			
					Total No. of eggs.		Total weight of eggs.	
					Above 2 ozs.	Below 2 ozs.		
					Above 2 ozs.	Below 2 ozs.	Above 2 ozs.	Below 2 ozs.
1	3	H. Tatham	Penhalonga	White Leghorns	828	156	109 lbs. 8 $\frac{4}{16}$ ozs.	17 lbs. 8 $\frac{12}{16}$ ozs.
2	12	Mrs. Walleen	Bembesi	do.	646	178	84 lbs. 1 $\frac{1}{16}$ ozs.	20 lbs. 3 $\frac{1}{16}$ ozs.
3	5	A. Hampson	Salisbury	do.	805	56	107 lbs. 14 $\frac{3}{16}$ ozs.	6 lbs. 9 $\frac{1}{16}$ ozs.
4	11	Mrs. Renton	Que Que	do.	638	129	86 lbs. 4 $\frac{1}{16}$ ozs.	14 lbs. 11 $\frac{3}{16}$ ozs.
5	13	A. R. Low	Gwelo	do.	627	218	81 lbs. 14 $\frac{1}{16}$ ozs.	25 lbs. 3 ozs.
6	16	W. Bands	Salisbury	Anconas	584	121	75 lbs. 8 $\frac{4}{16}$ ozs.	13 lbs. 13 $\frac{4}{16}$ ozs.
7	14	Mrs. Lloyd	Inyazura	White Leghorns	579	14	80 lbs. 15 $\frac{9}{16}$ ozs.	1 lb. 10 $\frac{1}{16}$ ozs.
8	18	W. F. Williams	Selukwe	do.	500	298	63 lbs. 0 $\frac{1}{16}$ ozs.	33 lbs. 12 $\frac{1}{16}$ ozs.
9	20	Mrs. Kimpton	Umtali	do.	395	211	50 lbs. 12 $\frac{1}{16}$ ozs.	22 lbs. 6 $\frac{3}{16}$ ozs.
10	2	Mrs. Gibbings	Avondale	do.	830	35	115 lbs. 9 $\frac{1}{16}$ ozs.	4 lbs. 1 $\frac{1}{16}$ ozs.
11	15	H. Fretwell	do.	Rhode Island Reds	577	139	76 lbs. 3 $\frac{1}{16}$ ozs.	15 lbs. 12 $\frac{1}{16}$ ozs.
12	6	T. Brokensha	Umtali	White Leghorns	773	33	105 lbs. 15 ozs.	8 lbs. 14 $\frac{1}{16}$ ozs.
13	1	C. L. Brown	Salisbury	do.	903	20	120 lbs 6 $\frac{1}{2}$ ozs.	2 lbs. 5 ozs.
14	9	J. S. Wreford	Bulawayo	do.	663	6	94 lbs. 4 $\frac{1}{16}$ ozs.	11 $\frac{5}{16}$ ozs.
15	8	D. O'Linn	Salisbury	do.	736	102	95 lbs. 15 $\frac{5}{16}$ ozs.	12 lbs. 12 $\frac{1}{16}$ ozs.
16	7	A. E. Speight	do.	do.	754	204	98 lbs. 11 $\frac{9}{16}$ ozs.	23 lbs. 12 $\frac{1}{16}$ ozs.
17	19	Mrs. Williamson	Banket	do.	458	156	58 lbs. 2 $\frac{5}{16}$ ozs.	17 lbs. 15 $\frac{2}{16}$ ozs.
18	10	Bray & Bull	Umtali	do.	708	160	91 lbs. 11 $\frac{3}{16}$ ozs.	18 lbs. 6 $\frac{1}{16}$ ozs.
19	4	Miss Greig	Bulawayo	do.	807	56	108 lbs. 15 $\frac{3}{16}$ ozs.	6 lbs. 12 $\frac{2}{16}$ ozs.
20	17	Mrs. Deall	Old Umtali	do.	575	394	71 lbs. 1 $\frac{1}{16}$ ozs.	44 lbs. 4 $\frac{1}{16}$ ozs.
Totals					13,386	2,688	1,777 lbs. 0 $\frac{1}{16}$ ozs.	311 lbs. 9 $\frac{1}{16}$ ozs.

Utility Standard for all Breeds of Poultry.

Appended is a standard submitted to and passed by the assembled delegates at the Annual Conference of the S.A. Poultry Association held in Bulawayo in November, 1920. This standard is a utility one applicable to all breeds of poultry and is compiled to enable poultry keepers to grade, select and mate their birds, no matter what breed, to produce good layers and strong vigorous birds. It is practically based upon that drawn up some years ago for the S.A. Utility White Leghorn Society, which has enabled this breed to forge ahead and produce so many excellent layers. Those who still wish to breed their birds for show can do so by following the old standards, but those who want eggs in large quantities would do well to follow the utility standard as here set down.

CONFORMATION.

A. Head and Adjuncts:—

1. *Head*.—Skull deep over eyes, rounded, base fully developed.
2. *Face*.—Clean, free from feathers and wrinkles, and not sunken.
3. *Eyes*.—Bright, full and expressive, free from drooping lids.
4. *Beak*.—Short, stout, thick at base, and well arched.
5. *Comb*.—Medium in size for breed, fine in texture.
6. *Wattles*.—Fine in texture, medium in size, almost transparent, free from wrinkles.
7. *Ear-lobes*.—Characteristic for breed in colour and size, lying close to neck, free from wrinkles, fine in texture.
8. *Neck*.—Medium in length, well arched, and with well-developed neck hackle.

B. Body:—

1. *Type*.—Characteristic for breed. Type is the intimate unity of all the points in a standard of perfection which go to form the ideal specimen of that particular breed of poultry.
2. *Breast*.—Deep and well-developed, showing graceful curve, keel short to medium in length.
3. *Shoulder and Saddle*.—Shoulders well set apart showing plenty of depth between top of shoulders and front point of keel, broad and flat across saddle, medium in length, saddle hackle in males well developed.
4. *Abdomen*.—Elastic, avoiding sagging, or fulness indicating excess of fat, deep between pelvic bones and end of keel in females, thighs and pelvic bones well set apart, pelvic bones

strong at base, long, fine and straight, to be as free as possible from grisly covering, skin of abdomen fine in texture and pliable, vent large and healthily moist, fluff fine and silky.

5. *Tail*.—Full and well spread, size and carriage characteristic for breed.
6. *Thighs, Legs and Toes*.—Thighs short to medium in length, well rounded, shanks medium to short in length, moderately fine in bone, rounded in front, toes straight and well spread.

C. Colour and Plumage:—

1. *Plumage*.—Colourings and markings characteristic for breed, feathers fine in texture, firm and close, but not hard as in game, fluff moderate.
2. *Colouring*.—Characteristic for breed.

D. Constitution or Stamina:—

As evidenced by condition and general appearance, alertness, clear, full bright eye, feathers and flesh firm, free from over-fatness.

General defects, applicable to all breeds, for which birds must be passed:—Roach back, wry neck, wry tail, knock knees, crooked toes, any other structural deformity, any indication of impurity of breed.

Weights and Scale of Points:—

A definite standard, including weights and embodying the above, along with a scale of points, will be necessary for each breed or variety of utility poultry.

In utility Mediterranean breeds a dubbed cock (not cockerel) be allowed to compete in a show breeding pen.

Missing Numbers of “Rhodesia Agricultural Journal.”

The Librarian, New York State College of Agriculture, Ithaca, New York, asks for the following numbers of the *Rhodesia Agricultural Journal*, for which he is prepared to pay liberally:—Vol. i., No. 7; Vol ii., No. 8.

Maize Production of the World.

FROM STATISTICS PREPARED BY THE DEPARTMENT OF
AGRICULTURE, BRAZIL.

Country.	Year.	Acres under cultivation.	Production in bags of 200 lbs.	Yield per acre in bags of 200 lbs.
<i>Europe—</i>				
Austria ...	1914	468,482	3,015,163	6·43
Bulgaria ...	1914	1,570,179	8,649,818	5·49
France ...	1916	811,780	4,656,434	5·76
Greece ...	1915	313,549	1,446,588	4·6
Spain ...	1916	1,153,929	8,017,565	6·96
Hungary ...	1915	6,191,727	50,537,720	8·12
Italy ...	1916	3,916,185	22,826,828	5·85
Rumania ...	1915	5,205,004	27,550,000	5·31
Russia ...	1916	3,664,833	20,151,532	5·44
Servia ...	1911	1,442,638	7,426,644	5·13
Switzerland ...	1916	3,705	42,427	11·47
Turkey ...	1910	770,272	6,215,348	8·08
<i>Asia—</i>				
China ...	1910	543,449	2,907,413	5·35
Corea ...	1915	152,172	662,264	4·37
British India ...	1915	6,185,003	...	...
India Native Territory ...	1914	1,064,506	...	...
Japan ...	1916	157,141	1,147,743	7·32
Philippines ...	1916	1,068,932	2,915,105	2·94
Russia, 6 Governments ...	1915	17,357	13,899	0·80
Russia, The Rest ..	1913	1,051,790	2,932,355	2·77
Turkey ...	1910	1,036,323	6,215,348	5·94

Country.	Year.	Acres under cultivation.	Production in bags of 200 lbs.	Yield per acre in bags of 200 lbs.
<i>Africa—</i>				
Algeria ...	1917	19,933	84,633	4.24
Egypt ...	1916	1,849,573	21,974,579	12.01
Madagascar ...	1915-16	155,074	815,860	5.27
Morocco ...	1916	355,156	861,676	2.41
Sierra Leone...	1916	5,498	7,390	1.34
Union of South Africa ...	1916	2,607,087	9,797,181	3.75
Rhodesia ...	1918-19	173,312	889,968	5.13
Tunis ...	1916	39,767	36,366	0.89
<i>America—</i>				
Argentine ...	1916-17	8,965,038	16,470,492	1.83
Brazil ...	1916-17	7,553,366	57,024,636	7.54
Canada ...	1916	172,925	1,758,451	10.18
Chile ...	1915-16	66,013	439,547	6.65
Colombia ...	1915	415,246	1,830,105	4.42
Costa Rica ...	1914	75,708	...	...
United States ...	1916	105,909,954	723,098,288	6.83
Guatemala ...	1917	617,547	2,906,745	4.69
Mexico ...	1916	2,764,002	37,180,099	13.48
Peru ...	1910-11	131,732	1,763,200	13.39
Uruguay ...	1915-16	696,525	1,288,707	1.83
<i>Oceania—</i>				
Australia ...	1916-17	318,630	2,379,218	7.45
New Zealand...	1916-17	6,417	79,235	12.37

List of Fertilisers Registered

DURING THE PERIOD 1ST APRIL TO 31ST DECEMBER, 1920.

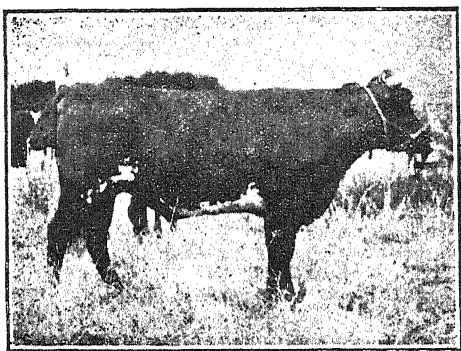
Manufacturer or importer.	Name under which fertiliser is sold.	Brand.	Phosphoric oxide.			Nitro- gen, per cent.	Potash, per cent.	Form in which nitrogen is present.	Form in which potash is present.
			Water soluble, per cent.	Citrate soluble, per cent.	Total, per cent.				
Rhodesia Meat Packing Co., Ltd, Odzi	Bone, meat and blood meal	Packnee	...	6.7	22.2	2.6	Nil	Bone, meat and blood	...
Rhodesia Fertilizers, Ltd., Box 340, Salisbury	Special potassic	R.F.L.	...	4.2	14.0	2.3	8.0	Guano 50%, bone 50%	Sulphate
do. do.	General	do.	...	3.0	10.75	2.25	3.25	Guano and ammon. sulph.	Sulphate
J. McLoughlin, B.S.A. Co. Estates Office, Salisbury	Nitrate of potash	Special im- portation	...	...	...	12.8	43.0	Nitrate of potash	Nitrate
do. do.	Sterilised bone meal	do.	...	...	20.6	3.9	...	Bones	...
do. do.	Superphosphate, high grade	do.	17.86	...	...	...	...	...	...

J. McLoughlin, B.S.A. Co. Estates Office, Salisbury	Sulphate of ammonia	Special im- portation	...	...	...	...	...	...	Ammon. sulph.	...
Anglo-African Trading Co., Ltd., Salisbury	Double Com- plete Safco	Safco	20	21	23	8	10	Nitrate	Ammonium salt and nitrate of potash	Nitrate
W. Cunningham, Stock Exchange Buildings, Bulawayo	Superphosphate, M.H.G. 15.2%	Champion	15.2	15.3	17.5	Nil	Nil	...	...	...
Rhodesia Fertilizers, Ltd., Box 340, Salisbury	Tobacco No. 1	R.F.L.	6	8.25	13.5	3	4	Sulphate	Guano 50%, ammon. sulph.	Sulphate
do.	Tobacco No. 2	do.	10	11.5	15.5	4	5.5	Sulphate	Guano 33 $\frac{1}{3}$ %, ammon. sulph. 66 $\frac{2}{3}$ %	Sulphate
W. Bain & Co. (S.A.), Ltd., Box 558, Salisbury	Mealie No. 1	Lochrin	...	6	14	2.5	2	Sulphate	Bone and whale meal and ammon. sulph.	Sulphate
do.	Mealie No. 2	do.	...	4	12	1.5	2.5	Sulphate	Organic (bone)	Sulphate
do.	Grain No. 1	do.	...	7	15	2.5	2	Sulphate	Organic bone and whale meal	Sulphate
do.	Grain No. 2	do.	...	4	12	2	2	Sulphate	Organic bone and whale meal	Sulphate
do.	Potato No. 1	do.	...	6.5	15	3	2.5	Sulphate	Organic bone & whale meal & ammon. sulph.	Sulphate
do.	Potato No. 2	do.	...	4.5	13	2.5	2	Sulphate	do.	Sulphate

Manufacturer or importer.	Name under which fertiliser is sold.	Brand.	Phosphoric oxide.			Nitro- gen, per cent.	Potash, per cent.	Form in which nitrogen is present.	Form in which potash is present.
			Water soluble, per cent.	Citrate soluble, per cent.	Total, per cent.				
W. Bain & Co. (S.A.), Ltd., Box 558, Salisbury	Tobacco No. 1	Lochrin	...	7	15	3	3	Organic bone & whale meal & ammon. sulph.	Sulphate
	do.	do.	...	4.5	12	2	3	do	Sulphate
	do.	do.	...	4.5	11	4	4	do.	Sulphate
	do.	do.	...	6.5	13	1	7	Organic bone	Sulphate
	do.	do.	...	5	24	3.5	...	...	...
	do.	do.	...	6.5	24	3.5	...	...	...
	do.	do.	8	9	11	2.5	3	Bone and whale meal and ammon. sulph.	Sulphate
Anglo-African Trading Co., Ltd, Salisbury	W.S. No. 2 Tobacco	do.	...	8	22	4.5	...	Bone	...
	Bone Dust D	Safco	...	8	22	4.5	...	Bone	...

Anglo-African Trading Co., Ltd., Salisbury	Double super-phosphate	Safco	40	42	43	...	...	...	...
Rhodesia Fertilizers, Ltd., Box 340, Salisbury	Bone meal	R.F.L.	...	6.5	22	3.5	...	Organic bone	...
Allen, Wack & Shepherd, Ltd., Bulawayo	Special Maize	Champion	11	11.1	13	1.5	1.5	Nitrate of soda and ammon. sulph.	Sulphate
do. do.	Special Potato	do.	9.5	9.7	10.7	2	3	do.	Sulphate
do. do.	Tobacco	do.	10	10.1	11.5	3	4	do.	Sulphate
do. do.	Salts of potash	do.	...	...	...	...	25	...	Sulphate
do. do.	Nitrate of soda	do.	...	...	...	1.5	...	Nitrate of soda	...
do. do.	Sulphate of potash, low grade	do.	...	...	...	...	48	...	Sulphate
do. do.	Sulphate of ammonia	do.	...	...	...	20	...	Ammon. sulph.	...
Bechuanaland Trading Association, Salisbury	Tobacco fertilizer	Os Kop	5	6.5	8.5	3	6	Ammon. sulph. and bone meal	Sulphate
do. do.	do.	Fertility	20	20.5	21.5	7.5	5.5	do.	Sulphate

Manufacturer or importer.	Name under which fertiliser is sold.	Brand.	Phosphoric oxide.			Nitro gen, per cent.	Potash, per cent.	Form in which nitrogen is present.	Form in which potash is present.
			Water soluble, per cent.	Citrate soluble, per cent.	Total, per cent.				
Bechuanaland Trading Association, Salisbury	Maize fertiliser	Os Kop	3	7.5	9	3	2	do.	Sulphate
Allen, Wack & Shepherd, Ltd., Bulawayo	Nitrate of potash	Champion	...	..	..	12	40	Nitrate of potash	Nitrate of potash
Rhodesia Fertilizers, Ltd., Box 340, Salisbury	Sulphate of ammonia	R.F.L.	..	.	.	20.5	...	.	...
Anglo-African Trading Co., Ltd., Salisbury	Rhodesia Maize Fertiliser	Safco	9	10	12	2	3	Oil cake, meat meal or dried blood	Chloride
Allen, Wack & Shepherd, Ltd., Bulawayo	Tobacco Fertiliser No. 2	Champion	8	8.2	9	4	4	Organic (whale guano) and nitrate	Sulphate and nitrate



Trevelloe Estates Cattle.

Fat Stock Sales at Gwelo.

A series of very successful competitions and sales of fat stock have taken place recently at Gwelo. Substantial money prizes for competition were given by all the local auctioneers, and the keen rivalry aroused was evidenced by the excellent quality of the animals exhibited and the numbers of the entries. The promoters have reason to be pleased with the result of their efforts, which will undoubtedly give a fillip to the cattle breeding industry as well as tend to popularise Gwelo as a centre for the sale of cattle of prime quality.

At Messrs. Schiff & Jacobson's sale on the 26th November over £200 was given away in prizes. The Trevelloe Estates, of which Mr. Thos. Bradshaw is manager, were conspicuously successful with their exhibits of Shorthorn grades, securing first and second prizes in the event for the best pen of six oxen, the prize for the champion ox and a second for the best pair of oxen. Mr. C. C. Macarthur was the winner of the latter event, showing two stocky Shorthorns bred by himself.

The following prices were realised at the subsequent sale:—

Champion ox (£10), Trevelloe Estates; bought by Mr. J. Austen, £35.

Six oxen (1st prize 100 guineas), Trevelloe Estates; bought by Mr. J. Austen, £33.

Six oxen (2nd prize £50), Trevelloe Estates; bought by Mr. W. H. Rogers, £35.

Two oxen (1st prize £30), Mr. C. C. Macarthur; bought by R. & R. Live Stock Co., £29.

Two oxen (2nd prize £15), Trevelloe Estates; bought by Mr. W. H. Rogers, £36.

The average of the 58 head exhibited was £29.

The Trevelloe Estates cattle, fed by Mr. T. Bradshaw, are stated to have killed 60 per cent. dressed weight, and he deserves great credit for the manner in which these oxen were finished.

At Mr. A. E. White's fat stock sale at Erin-go-Bragh, held on 3rd December, the first prize of £80 was awarded to Mr. J. R. Stewart of Shangani, and the second to the Trevelloe Estates, thus reversing the decision given at the sale just mentioned.

Messrs Boggie & Co held their fat stock shows and sales at Umvuma on the 18th and 19th November, and at Gwelo on the 24th and 25th of that month. Mr. P. O. Brocklehurst was the successful exhibitor in the event for the best pen of twelve oxen, Mr. C. E. Dickson for the best pen of five oxen, and Mr. W. van Heusden for the best pen of cows. The award for the best cow on the sale went to Mr. Tom Barnett.

The Agricultural Outlook.

The lateness of the rains this season gave rise to great anxiety among the farming community, and up to the end of December the position was undoubtedly serious. Copious rains have providentially fallen over the whole of the Territory since the beginning of the new year, and a different aspect has been placed upon matters. The rainfall in most districts is now (20th January) little behind the average, and the prospects for the season may generally be regarded as satisfactory. The area planted to maize may possibly be not quite so large as it was last year owing to the weather conditions restricting operations, but there is likely to be a considerable increase in side crops planted as catch crops. In this respect the untoward conditions of the early part of the season may perhaps prove a blessing in disguise, necessitating as they may have done the resting of the land from continuous cropping with maize.

The area planted under tobacco is considerably in excess of that planted last season. The lateness of the rains somewhat delayed planting, but the stands generally are good, and the crop is making very satisfactory progress. With favourable weather conditions the total production should be considerably above that of last season. Turkish tobacco is well advanced, and although the area planted is smaller, the quality of the product will no doubt be better than it has been for the two previous seasons. The matter of grading Virginia leaf is of the greatest importance to the industry, as it is unlikely that the Tobacco Warehouse will be able to cope with the amount of tobacco produced this season. Growers are urged to make proper provision for handling the crop at their farms.

The veld is at its best; cattle have regained condition, and generally are thriving. It may be opportune to draw attention to the necessity for making provision for winter feed in the form of ensilage or hay. Despite every precaution grass fires will occur, and unless feed in this form is available the result may be ruin. The position in regard to disease may be considered satisfactory. There is a fresh outbreak of African Coast Fever in the Melssetter district, but at existing centres of infection the disease appears to be under control. Cases of quarter-evil continue to occur, but the position is no worse. The despatch of slaughter stock to the Union is being maintained, and our exports for ten months of 1920 amounted to the very respectable total of £224,108.

There is no apparent shortage of labour, the supply being maintained by "foreign" natives, who have entered the Territory in unprecedented numbers during the past few months.

Wild dogs are active in various parts of the Territory, their depredations causing considerable losses. It should be better known that the Government pays a reward of 10s. for each fully-grown wild dog destroyed, and 5s. for each pup.

Veterinary Report.

October, 1920.

AFRICAN COAST FEVER.

GWELO, MAZOE AND MELSETTER DISTRICTS.—No cases during the month.

MATOBO DISTRICT.—The mortality at the Figtree centre of infection was 30 head. At Sauerdale there were no fresh cases.

QUARTER-EVIL.

The following mortality in cattle was reported:—Bulawayo, 89; Victoria, 60; Salisbury, 15; Melsetter, 24.

CONTAGIOUS ABORTION.

Two fresh centres of infection reported in Umtali district.

HORSE-SICKNESS.

One death in Melsetter district.

ANTHRAX.

One case in Mazoe district.

TUBERCULOSIS.

The tests and examinations of the animals in the infected herd at Shangani are being continued.

EPHEMERAL FEVER OF CATTLE (Three-days' Sickness).

A mild form of this affection was prevalent in Victoria district.

IMPORTATIONS.

From United Kingdom:—Bull, 1. From Union of South Africa:—Bulls, 4; heifers, 76; horses, 84; mules, 58; donkeys, 93; sheep, 1,289; goats, 295; pigs, 27.

EXPORTATIONS.

To Union of South Africa:—*Via* Liebig's Drift, cows and calves, 22; slaughter cattle, 401; *via* Bulawayo and Plumtree, 1,376; horses, 6;

mules, 4. To Northern Rhodesia :—Donkeys, 30; goats, 25; pigs, 4. To Belgian Congo :—Pigs, 5; sheep, 135. To Portuguese East Africa :—Mules, 2; horse, 1; donkeys, 2; slaughter cattle, 61; breeding cattle, 113; sheep and goats, 141.

November, 1920.

AFRICAN COAST FEVER.

UMTALI, MELSETTER, GWELO AND MAZOE DISTRICTS.—No cases during the month.

MATOBO DISTRICT.—At the Figtree centre of infection the mortality was ten head. At the Sauerdale centre there were no cases.

QUARTER-EVIL.

The following mortality in cattle was reported :—Gwanda, 11; Umzingwane, 12; Plumtree, 6; Belingwe, 30; Bulawayo, 8; Matobo, 10; Salisbury, 6. These do not represent the total mortality, as many cases are not reported.

ANTHRAX.

Two cases, in cattle, occurred in the Mazoe district, and the herds involved were vaccinated.

CONTAGIOUS ABORTION.

Fresh centres of infection reported from the Hartley, Gwelo, Charter and Selukwe districts.

HORSE-SICKNESS.

Three horses died in the Gwelo district.

EPHEMERAL FEVER OF CATTLE (Three-days' Sickness).

This disease appeared on several farms in the Victoria and Umtali districts, and in the latter a slight mortality occurred.

*SCREW WORM OF CATTLE.

Cases of this troublesome affection occurred in the Plumtree, Bubi and Nyamandhlovu districts.

ARSENICAL POISONING.

The mortality in all kinds of stock which is constantly occurring points to gross carelessness in the handling of cattle dip and other arsenical compounds.

IMPORTATIONS.

From the Union of South Africa:—Bulls, 22; cows, 43; donkeys, 100; horses, 102; mules, 43; sheep, 1,101; goats, 181; pigs, 7.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle *via* Liebig's Drift, 57; *via* Bulawayo and Plumtree, 359; pigs 16; goats, 60. To Northern Rhodesia:—Horses, 5; mules, 4; pig, 1. To Belgian Congo:—Sheep, 135. To Portuguese East Africa:—Slaughter cattle, 50; working oxen, 28; horses, 10; mules, 2.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Farming Calendar.

February.

BEE-KEEPING.

In some districts a second flow of honey may be looked for from the veld flowers and late growing crops. Honey being secured in either sections or shallow frames should not be permitted to remain too long on the hive at this time of year, as it will become soiled with the bees' feet. Robbers may be anticipated, and this is a sign that the honey flow is nearly over. Where stocks are short of food, feed rapidly inside the hive; excellent feeders can be supplied by appliance dealers. Queenless stocks can now be re-queened, or two stocks can readily be united by previously dusting each lot with household flour. Grade and dispose of honey. It may be advantageous to reserve the choicest specimens for exhibition and competition at our forthcoming agricultural shows.

CITRUS FRUITS.

The notes on planting still apply, if trees are still planted this month, an operation which, however, it is not desirable to leave so late. Trees planted after about the end of January may only get established when it is too late that season for them to commence growth, the consequence being that what growth there is is still sappy at the approach of the cold weather and so stands a chance of being nipped. In such case the tree would have been better left in the nursery row to be lifted and transplanted into the orchard the following spring.

By the end of February or early March the cover crop should be ready to plough into the orchard, with the possibility of sufficient rains after it is done to assist in rotting the plants in the soil. A continuous watch should be kept for insect pests, and fumigation or spraying undertaken immediately any pest is observed. If no cover crop has been sown, the orchard should be kept in a good state of cultivation, and not allowed to be overrun with grass and weeds. Destroy all fruit infested with citrus codling moth by burning or burying deeply. Do not allow the fruit to fall to the ground before destroying it, but pick all affected fruit as soon as it is observed. Considerable damage is done in some orchards by citrus codling moth, which can be controlled to some extent by using a poisoned bait made up as follows :

Arsenate of lead (paste), 2 lbs. or 3 ozs.
 Arsenate of lead (powder). 1 lb. or 1½ ozs.
 Treacle, 4 galls. or ½ gall.
 Or sugar (cheapest), 40 lbs. or 4 lbs.
 Water, 40 galls. or 4 galls.

Apply lightly in a coarse spray, getting a few large drops here and there throughout trees. Apply from beginning of the year until about early April every fortnight, and more frequently if rains wash off bait.

CROPS.

During this month the farmer's energies will be concentrated on keeping the lands thoroughly clean, and if this is done effectively now, no further serious damage from weeds need be feared. A special campaign should be waged against such weeds as Mexican marigold in the old lands, in headlands and on ant-heaps. Most summer crops will be in the ground. Maize for ensilage or fodder may still be sown, also catch crops of buckwheat and teff. The main maize crop should be cleared of suckers, which can be fed to stock. The most vigorous plants should be marked for seed selection by cutting the stalk above the cob, and the date of tasselling should be noted both in the main crop and the ensilage crop. In case of excessive moisture, the use of the wing shovel plough may be necessary. Monkey nuts should not be cultivated after the period of flowering, which is usually early in February. Hay-making should start in February if weather conditions allow. The sooner the veld is cut for hay the better the product obtained. Land for winter crops of oats and wheat should now be got ready as weather conditions permit. Napier's fodder slips planted early in the season can be divided. Potatoes are sometimes planted this month in order to obtain seed for the early plantings the following season.

DECIDUOUS FRUITS.

This is the time to carry out summer pruning, after harvesting the crop, and when the flow of sap begins to become sluggish.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down (see March). Certain caterpillars are sometimes troublesome. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912, "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915, and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds and tuber moth may call for attention; the latter, when very bad, sometimes causes considerable wilting of the crop besides attacking the tubers. See *Agricultural Journal*, October, 1913, and February, 1910.

Cabbage Family.—All members of the family are liable to the attack

of sawfly and webworm during February. See *Agricultural Journal*, February, 1914; April, 1910; and April, 1911. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime. See *Agricultural Journal*, 1918.

Beans and Cowpeas.—These suffer chiefly from stem maggot and blister beetles, which destroy the blossoms. The latter must be collected by hand. The former is dealt with in the number of this *Journal* for April, 1913.

Melon Family.—The most important pest is the melon fly, which “stings” the fruit of all species of gourds. At present no remedy is known except collecting and destroying the infested fruit early in the season. Aphis on the leaves and shoots may be destroyed by careful spraying with tobacco and soap wash or paraffin emulsion.

Mangolds and Beets.—These are frequently defoliated by caterpillars. Spray with an arsenical wash.

Citrus Trees.—The chief pest requiring attention during February is citrus codling. The infested fruit should be gathered and destroyed regularly. The fruit is also apt to be attacked by large fruit-piercing moths, for which unfortunately no remedy is known. For these and other pests see *Agricultural Journal*, February, 1916.

Deciduous Trees.—Apple, pear and late peaches suffer chiefly from fruit moths which puncture the fruit. No remedy is known except netting the trees.

Fig.—The fruit is liable to the attack of fig weevil. Infested fruit and all wild figs near the trees should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon disulphide into the burrow and sealing it up.

Castor Oil.—Two-year-old plants which contain borer should be cut down and burnt. See *Agricultural Journal*, October, 1912.

Mosquitoes, House Flies, Stable Flies.—Destroy all breeding places round the homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

FLOWER GARDEN.

During this month the flower garden is gradually approaching perfection, and nearly all plants are in bloom. If these are constantly plucked the yield will be increased, and except where required for seed, all flowers should be removed as they fade, for seeding shortens the life of many plants. All runners and creepers should have constant attention, and be tied up and trained. Dahlias in more exposed positions should be carefully tied to their stakes, as they now become top heavy with the weight of their blooms. Palms in the house and conservatory will benefit much if occasionally put out in the rain. Winter flowering sweet peas, if not already planted, should be sown as early as possible.

FORESTRY.

Complete planting out of ever-greens. Sow in nursery seeds of slow growing species such as cypress, pines, etc. All planting should be completed this month, in the early part if possible.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

All the very best cockerels should by now have been selected, either for the coming breeding season or for selling as breeders; the remainder should

have been sold for table or retained for doing so when they are of marketable age. Every cockerel, without exception, which is not of the best should be got rid of, and when the breeding season commences next month there should be no cockerels except those in the breeding pens and their reserves, and a few isolated for future poultry meat for the household.

The birds should now be chosen from which chickens are to be produced this coming breeding season; naturally these should be the best, viz., the best layers and the strongest and most vigorous birds, and on no account should any bird be chosen that has been ill and been cured, for to put any bird that is a poor layer, that lacks stamina and vigour, that has had an illness at any time during its life is courting trouble.

The birds chosen should have free range during this month, then mated up at the commencement of March. The first chicks should be out in April, and hatching should continue to the end of August, or at the latest to the end of September, but certainly not later.

During the wet weather the birds should be kept as dry as possible, otherwise eggs will be scarce, while those birds which are in moult will not come through it as quickly as they should. Get ready all coops, chicken runs, brooders; mend those which require attention, and have everything prepared for the reception of the chicks when hatched—do not leave everything to the last moment. Lack of care of chicks and proper attention means a set back, and when once the growth of a chick is checked it will never grow into a good bird; a fowl's life is made or marred in the first six or eight weeks of its life.

The scratching litter for the birds should always be kept dry; it is useless when wet, resulting in less exercise for the birds, and therefore less eggs, unfertile eggs, weak chicks and loss. A good depth, viz., $\frac{1}{2}$ foot to 1 foot, of scratching litter, in which all grain is buried, is *most* important, especially for birds that are being bred from.

STOCK.

Cattle.—Grass will now be at its best, and no anxiety need be felt about feed. In the case of milking cows which have been fed during the earlier rainy months, a little crushed and soaked mealies, or something similar, may still be given at milking, if only to bring them quietly to their places. The importance of a clean, light, airy and well-drained shelter for calves cannot be over-estimated. Calves up to three or four months old do not require a great deal of exercise, and on wet days are better left in a dry shed with a little sweet hay. A few hours' exercise on bright days in short grass is all they need. Vigilance in keeping down ticks must not be relaxed. These remarks apply specially to milking herds and to cattle that are kraaled. Cattle running at large need little attention beyond dipping, and if the calves are not desired from November to March, the bulls must now be taken out of the herd. Weather permitting, no opportunity should be lost of getting in a supply of good sweet hay before the grass is too old.

Sheep.—Vleis and low-lying ground must be avoided. Sheds should be airy, dry and clean. If grass seeds are troublesome to woolled sheep, an area should be mown for them, or when rain begins to slacken, they may be shorn. If wire worm is troublesome, dose and move to fresh grazing and kraals.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping and suckering should be given attention. Selected seed plants should be given careful attention. New land intended for tobacco next year should be ploughed this month, so that all organic matter turned under may be converted into humus before planting time next season.

VEGETABLE GARDEN.

Potatoes should receive attention and be carefully ridged up, and care taken that the stalks are not buried. Seeds for winter crops should be sown, such as beet, Brussels sprouts, cabbage, carrots, beans, peas, onions, turnips, tomatoes, etc. Vegetables planted out during this month might be placed a little closer together than usual, as watering may have to be resorted to before they mature.

WEATHER.

This is generally the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, $7\frac{1}{2}$ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

March.

BEE-KEEPING.

Be on the look-out for damage to stocks by the wax moth; strong stocks generally tend to obviate this pest. Where the heavy rains have penetrated the weak hive roofs and caused dampness among the quilts, these should be taken off and thoroughly dried in the sun, then replace. Contract the entrances of hives to prevent robbing. Unsold honey should be stored in a warm dry cupboard. Keep apiary clear of weeds.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

For general cultural treatment, see February notes. Mangels, turnips, rape and kale for autumn feeding may be sown in vlei soils or under irrigation during the latter half of this month. Haymaking will continue. Land for winter crops of oats and wheat should now be ready. The division of Napier fodder slips can be continued up to the end of this month. Buckwheat, linseed, teff grass and manna will be ready for reaping this month. The silo pit should now be got ready. Maize will be ready for ensilage in four to five weeks after the period of tasselling.

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood will be found freely in the stalks, but nothing can be done at this stage. Caterpillars may attack the crop during this month, usually as a sequence to cultivation after the weeds

have been allowed to get too far ahead. The caterpillars attack the crops on account of their food being suddenly destroyed. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912; "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915; and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but any plants still infested with stem borer should be removed and burned. Leaf miner will still be in evidence, and budworms may put in an appearance. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds may still be injurious. See *Agricultural Journal*, October, 1913. Careful hilling should be attended to on account of the tuber moth. See *Agricultural Journal*, February, 1910.

Cabbage Family.—Sawfly. See *Agricultural Journal*, June, 1918. The fly will probably be less injurious by this time. Cabbage louse may be on the increase. Very thorough spraying with tobacco wash and soap is of value when the plants are young.

Beans and Cowpeas.—The most obvious enemies are the blister beetles, which destroy the blossoms. These can only be destroyed by hand. Stem maggot continues injurious, causing dropping of leaves on the larger plants, but little can be done at this stage.

Melon Family.—Plants of this family are subject to the attack of melon fly and aphid. Careful spraying with tobacco wash or paraffin emulsion is of value against the latter.

Sweet Potato.—Hawk moth caterpillars occasionally appear in countless thousands and defoliate the crop. Immediate spraying with an arsenical wash is called for when the insects first appear. See *Agricultural Journal*, June, 1912.

Citrus Trees.—Attention should constantly be given to the systematic collection and destruction of infested fruit to keep down the citrus codling. Large fruit-piercing moths may attack the fruit during the month (see under February).

Deciduous Trees.—But little damage from insects is likely to occur to these fruits during March.

Fig.—Fig weevil still calls for attention in collecting and destroying the infested fruit.

Castor Oil.—See under February.

Mosquitoes, etc.—See under previous month.

FLOWER GARDEN.

During this month the garden should be seen at its perfection, and, owing to our rains, requires a great deal of attention in order to keep the soil free from weeds and caking. Drainage should also be looked to, in order to avoid plants being swamped or washed away. Dahlias and carnations should now be in their heaviest bloom, and will require tying up, and the dying blooms should be removed, in order to prolong their flowering period. Plants for winter flowering should now be coming on and planted out. Cuttings of carnations may now be made, and should be picked from the choicest plants, and taken from stems which have borne the finest blooms. The cuttings should be placed in boxes containing sand, and kept in a moist condition in a warm position sheltered from the winds. These should be ready for planting out in about two months, and bloom in three. Carnations, verbenas, antirrhinum, penstemon, pansy, dianthus, phlox, calliopsis and escholtzia may be sown for early blooming next spring.

FORESTRY.

If necessary, cultivate between the rows of trees planted out in the previous months. Plough any fire lines that are necessary and break up any new ground that will be required for next season's planting. Remember

that the roots of trees penetrate deeply into the ground, and therefore plough as deeply as possible. Where black wattle thrives, sow seed this month, after well soaking.

GENERAL.

At this time the condition of stock on the veld is good—perhaps at their best. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

The breeding birds should now have been mated up, *i.e.*, those that are the strongest and best layers. They should either be in a place quite apart from the other birds—those kept for eggs for market or eating—or if this cannot be arranged, all other birds should have been sold off, and only the breeding birds retained, and the smallest and bad shaped eggs from them used in the house, and the best set for hatching. It is no use selecting the best layers and strongest stock for breeding from if eggs from the poorer ones are also hatched. There will be no improvement, and it will be time wasted; yet we still often see people hatching from all and sundry. We have far too many bad and unprofitable birds in the country; every one of these should be scrapped, and *only* the good ones bred from.

Any bird that becomes broody now is very valuable: she should be placed in a comfortable coop, given a good dry soft nest of straw, and two or three china eggs; she will sit on these till the hatching eggs are ready. Dust the nest with a little Keating's insect powder, or a mixture of very fine (powdered) lime and flowers of sulphur. No hen can be expected to sit well unless she is comfortable, free from insects and has proper food, *viz.*, mealies (not too much), green food, charcoal and grit, and clean water.

The number of hens that can be given to a strong vigorous male bird with the certainty of fertility depends upon the size of the run and the amount of scratching exercise the birds are made to take; if a small run, say, 20 feet by 12 feet, six to eight hens are sufficient, and this number can be increased according to the size of the run up to 50 or 60 for one male bird if they have absolutely free range. For advice on incubation, refer to *Journal* for August, 1919, and for the rearing of chicks to *Journal* for October, 1919. Hatch all eggs laid by turkeys now; the chicks will come out when the wet weather has finished, and grow well during the subsequent months, and be ready for the Christmas markets. Duck eggs can be hatched at any time during the year, the chief precaution being to keep the young ducklings out of the direct rays of the sun. Dry food should be used to rear strong healthy vigorous chicks, with plenty of onions and onion tops cut small, and thick separated milk. This feeding will bring them on well and produce sturdy youngsters. The onions are a tonic, prevent colds and worms, and induce growth. Thick separated milk is the best preventative of diarrhoea and intestinal trouble we have; it keeps the general system in good order, and helps to put on growth.

STOCK.

Cattle.—The precautions recommended for February apply equally to March. Arrangements should be completed for storing as much silage as it is proposed to make, so that the crops reserved for this purpose may be harvested immediately they are ready.

Sheep.—The same precautions as for February should be taken, but as less rain may be expected, conditions will probably be more favourable. If late winter lambs are not desired, the rams should be removed from the flock.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed.

VEGETABLE GARDEN.

Tomatoes, peas and beans should be in full bearing, and should be staked and tied. Weeding and cultivation should be extensively carried out. Seeds for late winter crops—beans, cabbage, cauliflower, peas, radish, turnips, spinach and beet—should be sown.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

Agricultural Union Congress.

The date of the Rhodesia Agricultural Union Congress has been provisionally fixed for 17th, 18th and 19th March.

Weather Bureau.

The barometric pressure was normal during November and December. The mean temperature during November was considerably above the average, viz., 2 deg. above normal. The night temperatures were slightly below the normal, but the day temperatures were much higher than usual. The mean temperature during December was normal. The rainfall for the month of October was above the average for both Mashonaland and Matabeleland. Unfortunately this favourable condition was not maintained during November. The fall during this month was very much below the average throughout the country, and in many districts it was almost negligible. The average fall during November should be $2\frac{1}{2}$ inches in Matabeleland and $3\frac{1}{4}$ inches in Mashonaland, whilst this year the general fall only amounted to 1 inch. The fall in December was also well below the average in all parts of the country, with the exception of Wankie, Nyamandhlovu and Bulalima districts on the western border, and Belingwe and Victoria districts, where the fall was in excess of the normal. In Bulawayo, Umzingwane and Insiza districts the December fall was practically normal. In general the average December fall in Matabeleland should be $5\frac{1}{2}$ inches; this year it amounted to about $4\frac{1}{2}$ inches. In Mashonaland the average December fall should be $6\frac{1}{2}$ inches, whilst this year it amounted to 4 inches only. The accompanying list shows the mean rainfall for the various districts up to the end of December, 1920, as compared with the normal fall to the same date.

MASHONALAND:—

District.	Normal fall to end December.	Fall to end December, 1920.
Charter	10.95	6.45
Chibi	7.70	4.32
Chilimanzi	11.34	4.90
Darwin	10.48	6.60
Gutu	11.42	8.09
Hartley	11.57	7.51
Inyanga	11.51	10.41
Lomagundi	11.34	6.76
Makoni	13.55	6.34
Mtoko	10.44	5.55
Ndanga	16.82	10.86
Marandellas	12.30	5.96
Mazoe	11.38	5.11
Melsetter	17.33	12.45
Salisbury	11.88	6.39
Umtali	11.30	7.29
Victoria	10.78	9.82

MATABELELAND : - -

District.	Normal fall to end December.	Fall to end December, 1920.
Belingwe	8.56	8.74
Bubi	8.51	6.77
Bulalima	9.08	8.91
Bulawayo	9.01	8.16
Gwanda	8.72	5.19
Gwelo	11.02	6.62
Insiza	9.44	8.57
Matobo	9.26	7.75
Nyamandhlovu	8.42	9.41
Selukwe	13.28	8.50
Umzingwane	8.13	7.07
Wankie	9.23	8.20

It will be noticed that the position was particularly unfavourable in the maize-growing districts of Mazoe, Salisbury and Lomagundi, where the fall up to the end of December was 5 to 6 inches below the normal. In addition, the rains were very patchy and local, marked differences being recorded from adjacent stations. The position, however, improved considerably in the second week in January, when the general rains set in. The accompanying list shows the fall up to the middle of January from a few typical stations, as compared with the fall up to the same date last year.

Station.	Middle January. 1920.	Middle January. 1921.
Belingwe	5.75	13.16
Bulawayo	6.95	14.04
Enkeldoorn	14.71	15.62
Gatooma	11.00	9.30
Gwanda	6.84	8.59
Gwelo	16.26	11.71
Melsetter	12.36	16.57
Rusape	14.21	15.67
Salisbury	16.89	12.63
Shamva	8.56	7.99
Sinoia	17.32	9.52
Umtali	10.30	9.80
Victoria	10.44	12.82
Wankie	8.35	11.90

From this it will be seen that the total fall is in many cases higher than it was at the corresponding period last year, and the only marked differences are those of Sinoia, Salisbury and Gwelo.

RAINFALL.

STATION.	1920.		Seasonal to 31st December.
	November.	December.	
MASHONALAND—			
Bikita—			
Bikita	3.20	9.22	16.86
Charter—			
Buhera	0.11	2.32	4.44
Bushy Park	1.24	2.52	6.87
Enkeldoorn Gaol	0.89	3.57	6.74
Marshbrook	3.06	2.78	6.83
Range	2.27	2.44	6.50
Riversdale	2.36	1.85	5.29
Umniati	1.44	3.90	6.32
Vrede	1.40	5.08	8.56
Chibi—			
Chibi	0.09	3.52	5.30
Lundy River	1.73	2.29	6.28
Mwanezi	0.65	1.63	4.28
M'Kumi	3.45	1.96	6.55
Nuanetsi Rancho (Homestead)	0.20	1.56	3.28
Chilimanzi—			
Central Estates	2.04	1.86	5.98
Chilimanzi	0.06	2.69	4.49
Driefontein	0.50	2.86	4.23
Felixburg	0.78	4.60	7.08
Grootfontein	0.54	4.36	7.33
Induna Farm	0.14	2.61	4.22
Wylde Grove	0.38	3.55	7.57
Darwin—			
Mount Darwin	0.67	5.23	6.60
Gutu—			
Alheit Mission	0.35	4.98	8.59
Eagle's Nest Rancho	0.43	2.45	4.49
Glenary	1.30	6.19	8.89
Gutu	3.48	4.53	10.38
M'vimvi Rancho	0.08	2.95	4.21
Hartley—			
Ardgowan	1.95	2.08	7.07
Beatrice (B.S.A.P.)	2.02	4.34	7.52
Carnock Farm	3.87	3.63	8.77
Cringleford	3.20	4.62	9.20
Elvington	1.11	2.87	5.14
Gatooma	2.10	2.14	5.68
Gowerlands	3.18	1.72	6.68
Hallingbury	5.13	4.24	11.28

RAINFALL—(Continued).

STATION	1920.		Seasonal to 31st December.
	November.	December.	
MASHONALAND—(Continued)			
Hartley—continued			
Hartley Gaol	2.03	3.57	7.51
Hopewell	3.70	2.63	7.37
Ranwick	3.13	4.00	9.51
Spitzkop	1.15	1.92	4.80
Inyanga—			
Inyanga	2.61	4.92	10.41
Rhodes' Estate	2.44	6.63	12.21
St. Trias' Hill	2.77	3.55	9.37
York Farm	1.73	8.46	13.16
Lomagundi—			
Argyle	2.09	5.31	8.58
Duxbury Farm	2.79	2.46	6.14
Gambuli (Mukore)	2.59	3.15	8.02
Lone Cow Estate	3.95	2.81	7.00
Mafoota (n.s.)	1.59	3.91	5.70
Maningwa	2.66	3.86	8.35
Mpandaguta (n.s.)	2.17	3.03	6.52
Mukwe River Rancho	5.18	1.79	7.63
M'Vaami Farm	3.46	6.95	10.81
Palm Tree Farm	3.33	5.17	9.67
Sinoia	1.73	4.04	5.77
Sipolilo	1.90	1.50	3.40
Makoni—			
Chimbi Source (Chitora)	1.81	2.43	5.55
Craigendoran	1.78	3.12	7.44
Delta	1.99	4.23	6.98
Eagle's Nest Rancho	1.65	2.88	4.87
Forest Hill	3.57	2.71	8.49
Gorubi Springs	2.44	3.65	7.07
Makaha	2.50	4.89	8.49
Mona	1.96	2.74	6.12
Monte Cassino Mission	1.88	3.11	6.77
Rusape	2.75	4.26	9.80
Marandellas—			
Bonongwe	1.53	2.86	5.49
Igudu (Inoro) (n.s.)	3.51	3.95	8.46
Land Settlement Farm	1.09	2.01	4.19
Lendy Estate	1.41	4.59	6.52
Marandellas	0.97	4.47	6.43
Nelson	0.66	2.85	5.17
Tweedjan	3.05	4.54	8.54
Mazoe—			
Avonduur	1.21	2.85	4.38
Benridge	1.15	4.33	5.67
Bindura (Railway)	2.75	2.84	5.77
Ceres	2.35	2.18	4.77
Chipoli	2.19	2.46	4.70
Citrus Estate	2.00	3.21	8.16
Craigengower	1.77	3.60	5.58
Dunmaglas (n.s.)	0.41	2.01	2.58

RAINFALL (*Continued*).

STATION	1920.		Seasonal to 31st December.
	November.	December.	
ASHONALAND—(Continued)			
Mazoe— Continued			
Kingston	1.89	3.57	5.71
Limbeck (n.s.)	2.11	2.71	6.36
Mazoe	1.70	2.67	6.72
Mazoe Dam (centre)	3.03	3.98	8.64
Omeath	1.88	2.33	4.50
Ruia	1.30	4.11	5.70
Ruoko Ranche	2.76	2.19	5.74
Rustington (n.s.)	1.36	3.44	5.45
Shamva	1.36	1.63	2.99
Shamva Mine	1.67	1.05	2.94
Stanley Kop	0.61	4.21	5.21
Sunnyside	2.99	4.78	8.42
Teign	1.45	3.32	5.39
Virginia	1.27	3.79	5.40
Woodlands Farm (n.s.)	2.50	4.47	7.06
Melsetter—			
Helvetia	4.32	3.97	13.98
Chipinga	1.73	4.22	8.47
Melsetter	2.76	6.98	12.62
Mount Selinda	2.08	5.30	15.36
Tom's Hope	3.22	5.19	11.86
Mrewa—			
Mrewa	2.82	2.49	5.66
Selous Nek	5.35	3.13	9.90
Mtoko—			
Mtoko	2.00	2.73	5.55
Ndanga—			
Doornfontein	1.12	5.22	8.67
Ndanga	1.71	6.19	10.86
Salisbury—			
Avondale	2.35	4.59	8.01
Botanical Experiment Station	2.01	6.66	9.05
Bromley	1.62	2.01	3.83
Chishawasha	2.57	2.55	5.46
Forest Nursery	0.73	3.69	4.75
Glenara	0.81	3.17	4.76
Goromonzi	2.42	2.32	6.21
Gwebi	1.18	3.76	8.76
Hillside	1.44	4.11	6.49
Lilfordia	1.66	1.82	4.37
Manor Farm	1.60	2.44	4.89
Meadows (The)	2.20	3.26	6.39
Salisbury (Railway)	2.95	4.70	8.03
Selby	2.40	3.20	7.14
Stapleford	4.48	3.68	8.94
Tisbury (n.s.)	2.08	2.37	5.09
Umtali—			
Chiconga	4.12	3.07	8.16
Gilmerton	0.75	5.04	8.03
Hoboken	3.75	2.70	10.65

RAINFALL (*Continued*).

STATION	1920.		Seasonal to 31st December.
	November	December	
MASHONALAND—(Continued)			
Umtali—Continued.			
Odzani (Power Station) ...	2.96	3.46	10.02
Odzi Drift ...	1.93	2.86	5.65
Premier Estate ...	2.10	4.10	7.97
Gaol ...	2.07	3.87	7.51
Reservoir ...	2.23	4.23	9.52
Sarum ...	2.88	3.25	8.38
Stapleford ...	2.68	5.91	15.78
Stralsrund ...	6.33	2.79	11.57
Victoria—			
Brucehame ...	0.85	6.04	9.46
Clipsham ...	1.19	6.28	10.40
Gokomere ...	1.45	4.59	7.86
Histonhurst ...	0.90	5.19	8.87
Jichidza Mission ...	1.94	10.01	14.82
Makorsi River Ranche ...	0.80	8.07	12.54
Morgenster Mission ...	2.51	6.93	13.52
Riverdene North ...	0.97	7.01	10.99
Silver Oaks ...	0.40	5.54	8.18
Summerton ...	1.43	4.19	6.75
Stanmore ...	0.45	5.41	7.38
Victoria ...	0.61	6.53	9.43
MATABELELAND :			
Belingwe—			
Belingwe ...	0.77	5.15	8.74
Bickwell ...	1.23	5.15	8.68
Sovelele ...	Nil	1.35	2.18
Wedza ...	0.03	3.02	3.87
Bubi—			
Imbesu Kraal ...	0.34	5.27	6.77
Inyati ...	1.86	2.61	6.62
Shangani Estates ...	0.97	5.18	8.83
Bulalima-Mangwe—			
Empandeni ...	0.24	3.66	7.33
Garth ...	0.50	3.54	8.78
Retreat ...	1.34	7.15	9.20
Riverbank Farm ...	0.30	7.73	8.43
Solusi Mission ...	Nil	9.25	10.23
Tjankwa (Syringa) ...	0.58	4.30	7.03
Tjompanie ...	0.63	7.09	8.07
Bulawayo—			
Keendale ...	0.21	5.12	6.75
Khami, Fairview Farm ...	0.23	7.27	9.97
Lower Rangemore ...	1.43	6.06	8.81
Observatory ...	0.58	5.15	7.67
Ungusa ...	0.18	6.04	7.58
Gwanda—			
Gwanda (Gaol) ...	1.08	3.46	6.78
Lamulas ...	2.45	0.34	4.44
Lungalanga ...	1.06	1.11	3.48

RAINFALL (*Continued.*)

STATION.	1920.		Seasonal to 31st December.	
	November	December		
ATABELELAND—(Continued)				
Gwanda—Continued				
Mahalali	...	0·84	0·37	2·62
Mananji	...	1·40	1·15	4·42
Mapande	...	0·61	0·93	3·01
Mrandas	...	0·79	0·31	2·23
Mtshabezi Mission	...	0·08	2·35	4·18
Tuli	...	1·63	2·89	5·35
Gwelo—				
Cross Roads Farm	...	0·31	3·05	4·62
Dawn	...	1·65	3·49	6·40
Globe and Phoenix Mine	...	1·06	5·24	7·79
Gwelo (Gaol)	...	0·80	1·95	3·70
Lover's Walk	...	2·00	3·29	7·01
Lower Gwelo (Somerset)	...	1·82	3·68	7·03
Oaklands	...	2·28	3·03	7·12
Partridge Farm (n.s.)	...	1·47	2·72	6·20
Rhodesdale Rancho	...	1·55	3·28	6·40
Riversdale	...	1·57	8·11	11·24
Sikombela Farm	...	3·39	5·47	9·89
Woodendhove	...	0·70	2·68	4·93
Sheep Run	...	0·74	1·92	5·78
Insiza—				
Albany	...	0·65	4·32	6·37
De Beers' Old Homestead	...	0·50	3·50	5·50
Fort Rixon	...	0·93	5·93	9·28
Infiningwe	...	0·92	5·94	...
Inyezi Farm	...	0·45	4·18	5·57
Orangedale	...	0·79	5·52	8·69
Roodeheuvel	...	0·97	6·71	10·07
Thornville	...	0·29	3·81	6·05
Nyamandhlovu—				
Naseby Farm	...	0·91	7·09	9·41
Sebungwe—				
Gokwe	...	1·56	6·58	8·98
Inyoka	...	2·52	3·77	6·81
Selukwe—				
Aberfoyle Rancho	...	1·49	7·11	9·44
Rio	...	1·37	5·25	8·38
Selukwe (Railway)	...	2·43	4·55	8·50
Umzingwane—				
Essexvale	...	0·69	5·29	7·07
Wankie—				
Guyo	...	1·14	4·12	...
Lynwood Estate	...	2·21	5·42	8·41
Ngamo (Railway)	...	0·79	5·79	7·44
Waterford	...	1·47	4·88	6·84
Wankie Hospital	...	1·22	6·68	8·20

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1921			
			February	March	April	
Banket Junction	Banket Junction	C. Anderson	5	5	2	
Bindura	Bindura	G. Askew	11	8	12	
Bromley	Bromley	C. E. Deary	3	31	7	
Central-Mgezi	Farmers' Hall, Beatrix	W. Kentle	24	21	28	
Darwin	Umtali	M. W. Graham		25		
Eastern Border (South Melselter)	Aradia Farm and Mt. Darwin Store alternately	J. W. Giles	13	13	10	
Eastern Districts	Farm Ravenswood	J. W. Scott	11	11	8	
Ellisburg	Good Hope School	J. Rademeyer	12	12	9	
Felixburg	Arcurus Hotel	J. Watson	12	12	9	
Figtree Branch, R.L. and F.A.	Anta, Ellisburg, Noedale Farm	R. K. Hindson	12	12	6	
Gatooma	Figtree Hotel	E. King	26	26	20	
Gazaland	Gatooma	E. Seed	No	fixed	dates	
Greystone	Chipinga	W. Wood		24		
Headlands	Various farm houses, Shangani	M. Kerr				
Hartley	Royal Hotel, Gwanda	A. C. Edmonstone	19	19	16	
Hunter's Road Farmers and Stockowners	Headlands	J. Grewar	26	26	23	
Inanga	Headlands	J. de L. Ntumbo	No	fixed	dates	
Inyanga	Shangani	M. W. Willey	12	12	9	
Inyazura	Farm Juliusdale	M. E. W. Hacking	12	12	9	
Lapanshi	Inyazura	P. H. Bohls	12	12	9	
Lomani	Shinola	R. E. Courthope	10	10	14	
Lomani	Shinola	J. G. Clarkson	19	19	23	
Macheke	Macheke	W. L. McLean	No	fixed	dates	
Makwiro	Makwiro	I. M. Nyame	18	18	15	
Makoni	Mr. Wiggall's Farm, Makoni South	W. B. Tinson	23	23	27	
Marandellas, Northern	Rusape	A. V. Stanley	2	2	6	
Marandellas, Southern	Inoro	A. E. Scott	4	4	1	
Masop Branch, R.L. and F.A.	Commercial Hotel, Salisbury	C. Cyril Allen	No	fixed	dates	
Mazoe	Various farm houses	S. Gillespie	9	9	13	
Melselter (North)	Good Hope Siding	Mrs. Foxall West	6	8	12	
Melselter (South)	Various farm houses	R. Wotehouse	6	8	12	
Norton and District	Yarol Hotel, Gwelo	A. Tulloch	10	10	7	
Norton	Farm Summerfield	W. Wrench	10	10	16	
Rhodesian Landowners and Farmers	Norton Store	E. J. Ross	14	14	16	
Selous	Que Que	H. S. Hopkins	10	31	28	
Shamva	Library Buildings, Bulawayo	A. L. Douglas	10	19	16	
Solukwe	Various farms	C. L. Somerset	No	fixed	dates	
Umtali	Shamva	Capt. G. H. Gordon	17	17	21	
Victoria	Various ranches	J. S. Holland	3	3	7	
Western	Royal Hotel, Umtali	Major A. J. Dunn	4	4	1	
	Victoria	W. R. Boucher	12	12	9	
	Plumtree Hotel					

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

Co-operative Experiments.

WINTER CEREALS.

With a view to encouraging the growing of winter cereals, both under irrigation and on vleis soils, and also of introducing new varieties which may prove superior to those at present grown, it is hoped that the following varieties will be available for free distribution from the beginning of March onwards:—

Wheat.—Early Gluyas, Early Australian, American No. 8, Union No. 17, Lalkasar Wahl and Zwart Aar.

Barley.—Smyrna—malting type.

Oats.—Algerian and Boer.

Rye.—Cape Early.

At the date of going to press it is not certain that all the above varieties will be obtainable. In any case, stocks are limited, and not more than three kinds of seed can be sent to any one applicant.

All applications should be addressed to the *Chief Agriculturist and Botanist, Department of Agriculture, Salisbury*.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 106. Cultivation and Preparation of Ginger.
- No. 152. A School of Agriculture for Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture.
- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 181. Sunflower Cultivation, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.

- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
 - No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
 - No. 310. Tobacco Cultivation, Selection and Grading, by H. W. Taylor, B.Agr.
 - No. 326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
 - No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
 - No. 334. Flue Curing Tobacco Barns and Packing House, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 - No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
 - No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
 - No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
 - No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops, 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 307. Rainfall Statistics, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
 No. 145. Prospects for Importation of Cattle from Australia, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 163. Feeding and Care of Imported Cattle, by R. C. Simmons.
 No. 195. Some Notes on the Systematic Dipping of Stock, by C. R. Edmonds, Assistant Chief Veterinary Surgeon, and L. E. W. Bevan, Government Veterinary Bacteriologist, Southern Rhodesia.
 No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
 No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by R. C. Simmons.
 No. 227. An Experiment in Beef Production, by R. C. Simmons.
 No. 229. Breeding and Feeding of Pigs for Bacon Factory Purposes, by R. C. Simmons.
 No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
 No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
 No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 No. 255. Pound Fees.
 Arsenite Cattle Dip—How to Mix.
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
 No. 288. Stock Records for Ranches in Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 292. Branding and Drafting Pens, by R. C. Simmons.
 No. 301. Pigs as an Adjunct to Dairying on Granite Veld Farms, by R. C. Simmons.
 No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
 No. 323. Bacon Curing on the Farm, by Jas. B. Fisher, N.D.D.
 No. 331. Theory and Practice of Feeding Cattle in Southern Rhodesia, Part I., by R. C. Simmons.
 No. 332. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part II., by R. C. Simmons.
 No. 340. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
 No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
 No. 336. Butchering and Flaying.
 No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.

DAIRYING.

- No. 184. Cream, its Separation, Handling and Sale to Butter Factories, by R. C. Simmons.
 No. 205. Home Butter Making, by R. C. Simmons.
 No. 243. Shedding for Milch Cows, by R. C. Simmons.
 No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 284. Establishment of Dairy Herd on Granite Veld, by R. C. Simmons.
 No. 308. Cream Cheese, by J. B. Fisher, N.D.D.
 No. 311. Gouda Cheese Making, by J. B. Fisher, N.D.D.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 82. Difficult Parturition of the Cow, by C. R. Edmonds, M.R.C.V.S., G.V.S.

- No. 95. Oestrus-ovis in Sheep, by Alec King.
- No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
- No. 272. African Coast Fever: Schedule of Outbreaks to 1916, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
- No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
- No. 312. Anthrax, by C. R. Edmonds, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.

IRRIGATION.

- No. 64. Hints on Irrigation—Small Gravitation Schemes, by W. M. Watt.
- No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
- No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
- No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
- No. 217. Windbreaks and Hedges, by F. B. Willoughby.
- No. 234. Eucalypts suitable to Southern Rhodesia, and how to Grow them. by F. B. Willoughby.
- No. 236. Notes on Propagation by Means of Cuttings in Rhodesia, by F. B. Willoughby.
- No. 267. Trees for Farm and Ornamental Purposes, by W. E. Dowsett.
- No. 366. The Management of Woods, by J. S. Henkel.
- No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
- No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
- No. 265. Rose Culture, by N. L. Kaye Eddie.
- No. 296. Citrus Nursery Work, by A. G. Turner.
- No. 354. The Home Orchard, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
- No. 147. Root Gallworm, by R. W. Jack, F.E.S.
- No. 148. Darkling Beetle Grubs Injurious to Tobacco, by R. W. Jack, F.E.S.
- No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
- No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants. by R. W. Jack, F.E.S.

- No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
- No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
- No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
- No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
- No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
- No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
- No. 219. More Household Insects, by R. Lowe Thompson, B.A.
- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
- No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
- No. 291. Cutworms, by Rupert W. Jack, F.E.S.
- No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
- No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
- No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.

POULTRY.

- No. 198. Poultry Keeping for the Rhodesian Farmer, by Frank Sheppard.
- No. 343. Poultry Husbandry; Breeding and Selection for Increased Egg Production, by A. Little.
- No. 355. Poultry Husbandry—Principles of Breeding and Mating, by A. Little.
- No. 365. Poultry Husbandry: Treatment of Adult Birds, by A. Little.
- No. 371. Ducks, by A. Little.
- No. 377. The Fowl Tick, by A. Little.

MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
- No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
- No. 254. Hints on Explosives, by W. M. Watt.
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
- No. 271. Nature Notes—Plant Collecting, by F. Eyles, F.L.S.
- No. 273. Enkeldoorn Produce Express Syndicate Rules.
- No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCansland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
- Directory of Rhodesian Farmers and Ranchers.
- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.
- Pisé de Terre Buildings, by A. A. Muir.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 595 of 1920.]

[26th November, 1920.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

IT is hereby notified that His Honour the Acting Administrator has been pleased, under and by virtue of the powers conferred on him by the "Animals Diseases Consolidation Ordinance, 1904," as amended by the "Animals Diseases Amendment Ordinance, 1918," to make the following amendments to the regulations published under Government Notice No. 21 of 1917 (hereinafter referred to as "the said regulations").

1. Section 5 of the said regulations is amended by the following addition at the end thereof :—

"The granting or refusing of such permission shall be at the sole discretion of the officer authorised to issue the same. Such officer, in considering applications for such permission, shall have regard to the extent to which the 'Cattle Cleansing Ordinance, 1918,' and any other laws or regulations relating to disease among cattle, are being carried out in respect to the cattle or land concerned in the proposed movement, whether the person applying for permission has contravened any of the said laws or regulations or not, and such other matters as may be relevant to the prevention or suppression of cattle diseases."

An appeal from any refusal to issue a permit shall be to the Controller or Chief Inspector of Stock.

2. Section 6 of the said regulations is hereby repealed and the following substituted in lieu thereof :—

"(1) No special permission to move cattle shall authorise such movement by any route other than a public road, that is a road the use whereof is common to the public at large, or by a prescribed stock route, without the written consent of the landowners entitled to object to such movement, and in the case of movement across native reserves, without the written consent of the Native Commissioner of the district in which such reserve is situated. The officer entitled to authorise such special permission may refuse to consider the same until furnished by the applicant with written consents as aforesaid.

"(2) Whenever a special permission authorises the movement of cattle by a public road or prescribed stock route, the holder of such permission shall, if the number of cattle exceeds fifty, or in the case of bulls, unless led by an attendant for each bull, notify in

writing the owner, occupier or manager of occupied land traversed by such road or stock route, or in the case of native reserves, the Native Commissioner of the district in which such reserve is situated, of the number and description of the cattle being moved and the date on which they will cross such land or reserve.

“(3) Any person moving cattle without the consents or notices provided for in clauses (1) and (2) hereof, respectively, shall be deemed guilty of a contravention of these regulations.”

3. These regulations shall be read as one with the regulations published under Government Notice No. 21 of 1917, as hereby amended.

No. 614 of 1920.]

[10th December, 1920.

“ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904.”

HIS Honour the Administrator in Council has been pleased, under the provisions of the “Animals Diseases Consolidation Ordinance, 1904,” to cancel Government Notice No. 478 of 1920, and, in terms of section 17 of Government Notice No. 21 of 1917, declare the following area of infection:—

UMTALI NATIVE DISTRICT.

(a) *Area of Infection.*

The farms N'Odzi and Nyagari.

No. 608 of 1920.]

[3rd December, 1920.

“GAME LAW CONSOLIDATION ORDINANCE, 1906.”

IT is hereby notified that His Honour the Acting Administrator has been pleased, under the provisions of the “Game Law Consolidation Ordinance, 1906,” to cancel from date hereof Government Notice No. 297 of 1920, which suspended the operations of sections 9, 10 and 12 of the said Ordinance in respect of all game within a certain area in the Wankie district.

No. 635 of 1920.]

[17th December, 1920.

“EXPORTATION AND IMPORTATION RESTRICTION ORDINANCE, 1920.”

IT is hereby notified that His Honour the Administrator has, under and by virtue of the powers conferred upon him by section 1 of the “Exportation and Importation Restriction Ordinance, 1920,” been pleased to prohibit the exportation of the following articles from the Territory of Southern Rhodesia to the destinations specified without his permission in writing, or the permission in writing of some officer duly authorised by him to grant the same:—

(a) To all destinations—

- (1) Maize and maize products.
- (2) Rice.
- (3) Sugar.
- (4) Wheat in the grain, wheaten flour and wheaten meal.
- (5) Bones, crude potash in any form, guanos, or any preparations of such bones, potash or guanos capable of being used in the manufacture of fertilisers.

(b) To all destinations other than in the United Kingdom or British Colonies, Protectorates and Possessions—

- (1) Ammunition.
 - (2) Butter.
 - (3) Cocaine.
 - (4) Explosives other than industrial explosives.
 - (5) Firearms.
 - (6) Opium.
- (c) To Russia, Germany, Austria, Hungary, Bulgaria and Turkey—
(1) Aircraft.

No. 636 of 1920.]

[17th December, 1920.

IT is hereby notified that His Honour the Administrator has been pleased, in terms of section 1 of the "Exportation and Importation Restriction Ordinance, 1920," to authorise the following officers to grant permission for the exportation from the Territory of Southern Rhodesia of the articles prohibited to be exported by Government Notice No. 635 of 1920, viz. :—

- (1) In respect of maize and maize products—The Secretary to the Treasury, Salisbury.
- (2) In respect of bones, crude potash in any form, guanos, or any preparations of such bones, potash or guanos capable of being used in the manufacture of fertilisers—The Director of Agriculture.
- (3) In respect of other articles specified in the above-mentioned Government Notice—The Controller of Customs and Excise, Bulawayo.

No. 607 of 1920.]

[3rd December, 1920.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
C. C. Townsend	Chinyika	Mazoe	Farm Lowdale
Henry Mond	Tatagura	Mazoe	Farm Springvale
G. C. Nielson	Unnamed	Gwelo	Farm Penderry

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 628 of 1920.]

[10th December, 1920.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Robert Wodehouse	Umvumvumbu	Umtali	Farm Penkrigde

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 651 of 1920.]

[24th December, 1920.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Geo. R. Holgate ...	Bumani	Bubi	Farm Induba

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 25 of 1921.]

[14th January, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
H. O. Backhouse	Shawanoia River	Mrewa	Farm Solid

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No 42 of 1921.]

[21st January, 1921.]

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
H. K. Kimpton	Princes Spruit	Umtali	Ferndale

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

RHODESIA Agricultural Journal.

ISSUED BY
The Department of Agriculture,
SALISBURY, RHODESIA.

ADVERTISEMENTS.

The Journal is issued every alternate month.

Application for advertising space should be addressed to the Editor. The rates are as follows, *per issue* :—

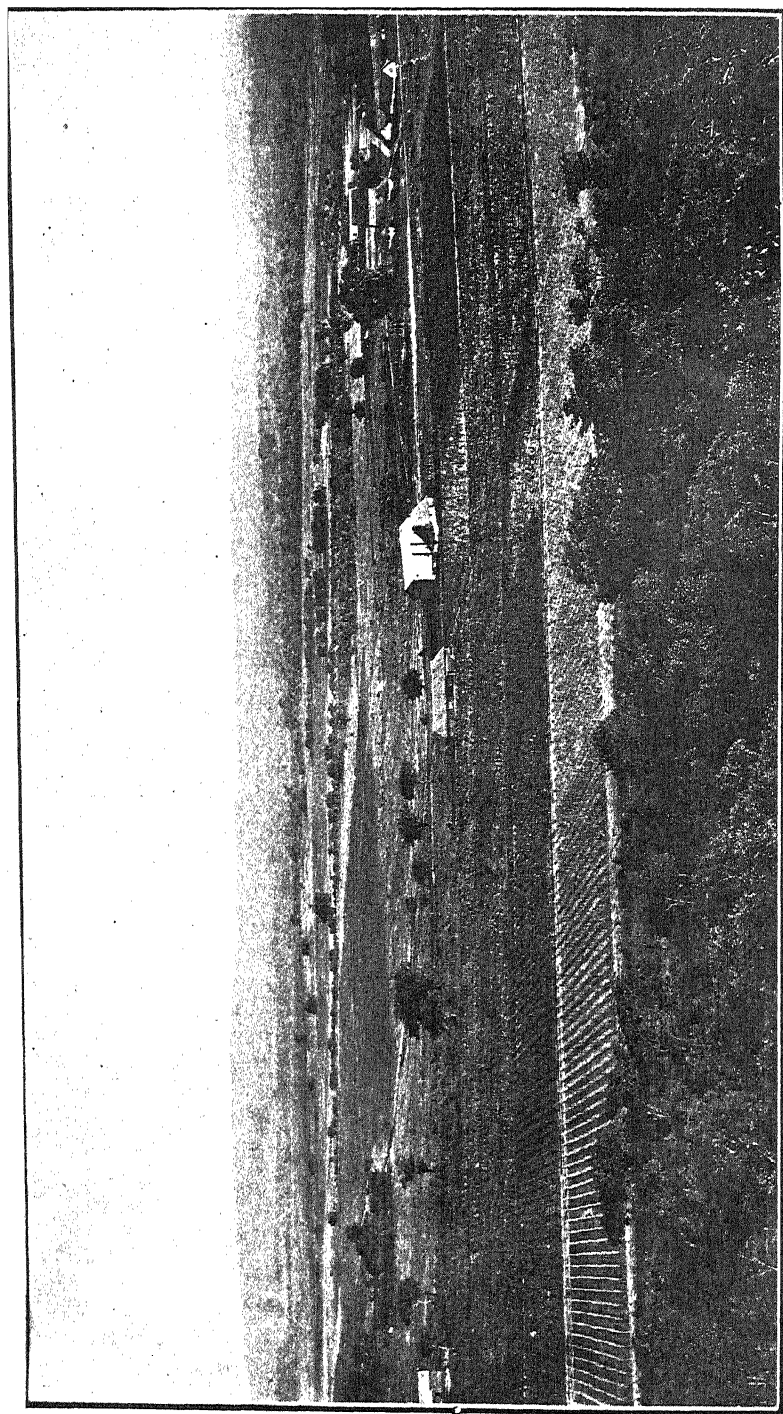
Position.	Whole page.			Half page.			Quarter page.		
	£	s.	d.	£	s.	d.	£	s.	d.
Inner pages	2	8	0	1	10	0	0	18	0
Outer cover (back)	4	16	0	—	—	—	—	—	—
Inner covers (back and front)									
and page facing Contents	3	12	0	2	2	0	1	4	0

A discount of 10 per cent. will be allowed for standing or consecutive advertisements running through six issues. Remittances, and electros where desired, should accompany orders. The right is reserved to discontinue the insertion of standing or consecutive advertisements should payment beyond the second issue be delayed.

The right of approval of all advertisements by the Director of Agriculture is reserved, and his decision as to the acceptance or rejection is final.

An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words.



British South Africa Company's Citrus Estate, Sinoia.



THE RHODESIA Agricultural Journal.

Issued by the Department of Agriculture.

PUBLISHED BI-MONTHLY.

Subscription: 5/- per annum.

VOL. XVIII.]

APRIL, 1921.

[No. 2.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—

The Editor, W. E. MEADE,
Department of Agriculture,
Salisbury.

A Sand Veld Experiment Station.—Through the munificence of Colonel Sir Harry Waechter, Bart., the Department of Agriculture has been provided with a small sand veld experiment station situated on Arlington Estate. The land allotted to the Department for this purpose lies about six miles south of Salisbury by good road, and will therefore be readily accessible to all farmers visiting the capital.

Sir Harry Waechter generously undertakes to provide the necessary land and to defray all expenses in connection with the station, including the salary of a manager, whose work will be directed and supervised by the technical officers of the Department. The land at present allocated for this purpose consists of a typical granite sand vlei, together with the dryer slopes adjoining it. The work of breaking up and preparing the vlei for winter crops was commenced early in February, and though this

is not as early preparation as is advisable, it is hoped that it may be possible to plant about ten acres to winter cereal experiments sown from the middle of April onwards.

The urgent need for a sand veld experiment station has long been realised, and by his generous provision for one, Sir Harry Waechter has earned the gratitude not only of the Department of Agriculture, but of every sand veld farmer in Rhodesia.

Visit of Farmers to Gwebi Experiment Farm.—Thirty-five farmers visited the Gwebi experiment farm on the 21st March at the invitation of the Director of Agriculture to inspect the work in progress. The visitors were shown round the plots by the officials in charge of the experiments, and the objects of each series explained. Keen interest was evinced in the trials, and the opinion was generally expressed that the crops were looking extremely well. The rotation experiments attracted particular attention, the marked differences already showing up being the subject of much comment. Some surprise was also expressed at the success obtained with summer oats which were being grown from seed raised in Rhodesia each successive season since 1914. It is not necessary to refer in detail here to the experiments in progress, as full particulars will appear in this *Journal* when the crops are reaped. The visitors testified to having spent a most instructive and pleasant day, and referred in appreciative terms to the manner in which the work at the farm is being carried out.

Investigation of Plant Diseases.—An Imperial Bureau of Mycology has been established at Kew, England, with Dr. E. J. Butler, late Imperial Mycologist, Director of the Research Institute, India, and Agricultural Adviser to the Government of India, as Director. The Bureau is the outcome of a proposal unanimously adopted by the Imperial War Conference in 1918 that a central organisation should be established for the encouragement and co-ordination of work throughout the Empire on diseases of plants caused by fungi in relation to agriculture. The committee of management consists of some of the foremost biologists in Great Britain, with Viscount Harcourt as their chairman. The funds of the Bureau are entirely provided by contributions from the various self-governing Dominions, India, Egypt and the Sudan, and the non-self-governing Colonies and Protectorates. It will work broadly on the lines of the existing Imperial Bureau of Entomology at South Kensington, and will aim at doing for the other great class of destructive agencies in agriculture, namely, the diseases and blights of plants, what the older Bureau has so successfully done in regard to injurious insects. It will be a central agency for the accumulation and distribution of information, and for the identification of specimens sent in from all parts of the Empire. It is proposed to issue, as soon as funds permit, a periodical journal through which those interested in mycological work in regard to agriculture will be kept informed of progress elsewhere.

There are at present over fifty officials engaged in this work in the overseas parts of the Empire, while the number of agriculturists, planters and the like practically interested is legion.

The effect of fungus diseases in reducing crop production is great beyond calculation. A Canadian scientist has estimated the loss caused by rust in wheat in the prairie region of Canada in 1917 at 100,000,000 bushels, representing a value of between £25,000,000 and £50,000,000. For the same year the loss in the five chief cereals in the United States exceeded 400,000,000 bushels. The effect of this on the provisioning of the world may be easily imagined.

In Southern Rhodesia the loss to the tobacco crop through a bacterial disease and from mildew amounts to many thousands of pounds sterling yearly, whilst serious damage is also reported to our oranges from fungoid diseases which develop during the long overland journey prior to shipment. In common with the rest of South Africa, rust of wheat and oats is ever in evidence and prevents the culture of these crops from becoming general. Last year the maize crop was severely injured by *diplodia*, a fungoid disease which attacks the ears, and in cases of severe infestation renders the grain valueless, while white rust often diminishes the yield. There is great need for the investigation of these diseases, and the establishment of an Imperial Bureau will undoubtedly help in finding remedies, although study on the spot, if it could be arranged, would be even more likely to yield good results.

Wheat Growers' Association.—At a meeting held under the auspices of the Mashonaland Farmers' Association on the 15th March, it was decided to appoint a committee to organise the wheat growing industry on the lines so successfully adopted recently by the maize growers. It was generally thought that as wheat growers as a whole are so widely scattered it would be better for members to join the Maize Growers' Association and to work under the existing organisation of that association, with, however, a separate executive to deal with all matters of paramount importance to wheat growers.

The time has undoubtedly come when organisation of the nature indicated is necessary, for the growing of wheat as a winter crop now occupies an important place in our farming practice, and shows signs of considerable expansion. Such an association as is contemplated can do much good work in the way of regulating prices, establishing pure seed supplies and in encouraging a more extensive trial of wheat among farmers possessing suitable soil. The use of pure seed is of the greatest importance, and as we remarked in a recent issue of the *Journal*, growers of wheat have allowed their varieties to become so mixed that pure Rhodesian seed is practically unobtainable in the country to-day.

We would draw the attention of those interested in the growing of wheat to the report appearing in this issue of the co-operative experiments carried out last year with various varieties of seed. These experiments have been conducted for many years for the purpose of

ascertaining what wheats do well under Rhodesian conditions and which varieties are most suited to particular localities. The position with regard to wheat differs radically from that of maize, as different classes of wheat are required for blending in the production of a high class flour. The returns obtained by Mr. Radcliffe, of Victoria, and Mr. Mells, of Norton, on irrigated and unirrigated land respectively are worthy of note.

Wheat Growing under Irrigation.—A good deal of attention has been focussed of late on the question of wheat growing both as a winter and summer crop. At the present time the bulk of the wheat produced in the country is grown as a winter crop either under irrigation or on wet vleiland. In the absence of a rust-proof wheat it appears probable that wheat must be largely considered a winter crop, and one to which the farmer having land under irrigation or capable of being irrigated should give his close attention.

In what might be termed the occupied portions of Southern Rhodesia there are some 32,000 acres of land which have been reported upon as irrigable, of which area only about 10,000 acres are under irrigation to-day. Many of the possible irrigation schemes awaiting development in the country need only a comparatively small outlay, and would therefore well repay being undertaken even on the basis of wheat growing alone. In many parts of South Africa a capital cost of £25 per acre irrigated is considered not an excessive figure for bringing land of medium quality under irrigation, and even with this outlay added to the original value of the land wheat growing is considered a paying proposition.

A capitalisation for irrigation works of from £10 to £12 per acre would suffice to construct many of the smaller schemes awaiting development in Southern Rhodesia to-day, and it cannot be doubted that such an expenditure would soon be justified, especially when it is realised that wheat grown under proper irrigation conditions will yield at least six bags per acre.

The extension and development of land under irrigation is not only of interest to the wheat grower, but to the dairy farmer and all others who look forward to the development of the country through closer settlement.

Rhodesian Butter in England.—During the past few months butter has been exported to England from the Gwelo Creamery by the Farmers' Co-operative Industries, Ltd. The butter is sent by rail to Capetown in insulated trucks, and is graded there by the official graders of the Union Government. For this facility we are indebted to the Superintendent of the Division of Dairying. We have also to thank the Union Government for extending the terms of the contract entered into with the Imperial Government to include our locally manufactured

product. This is the beginning of what promises to be a large and lucrative export trade, as Rhodesia is now producing an amount of butter in excess of its requirements for which it will be necessary to find a market overseas. It is probable that the present contract between the Union Government and the Imperial Government will terminate when dairy products in the United Kingdom are de-controlled. Rhodesia will then enter into competition with other countries long experienced in this trade, and it will become imperative to manufacture butter of first quality. The quality of butter depends almost entirely upon the quality of the cream supplied to the creamery, and it lies with the farmer of this country to determine whether Rhodesian butter is to gain an honoured place in the world's markets. This can only be done by careful treatment of the milk and by ensuring the delivery of a first grade cream to the creamery.

Poultry Show at Bulawayo.—The enterprise of the Bulawayo and District Poultry Club in organising a young bird show was rewarded by the success which attended their inaugural venture at Bulawayo on the 26th February. These young bird shows have for some years been held in England and America, and have recently been tried in the Union of South Africa. They are held just prior to the breeding season, when birds are being mated up, and provide a useful illustration of the type of bird that should be kept for breeding purposes. Such exhibitions also serve a useful purpose in affording an indication as to the class of bird exhibitors will have to compete against at the bigger shows, and as such must tend to raise the standard.

At Bulawayo all the birds were less than six months old, and as an object lesson the show was of great value, not only to the novice, but to the experienced breeder as well. There were about 250 entries, and the quality of the birds and the condition in which they were shown elicited high praise from the judges, Mr. A. Little and Mr. J. McLean. The show, we understand, was a success financially, and we congratulate the promoters upon the result of their efforts.

Egg-Laying Test.—The first Southern Rhodesia egg-laying test terminated on 1st March, 1921, and we publish elsewhere in this issue the final results. The test extended over a period of 45 weeks, and the total number of eggs laid by the 100 birds was 18,067, or an average per bird of 180.67 eggs. The winning pen, No. 13, White Leghorns, produced 1,087 eggs (total weight 145 lbs. 6 10-16 ozs.), an average of 217 per bird for the 45 weeks or approximately 250 per bird per year. This is an excellent record, and we congratulate the owner of No. 13 pen, Mr. C. L. Brown, upon the result. The best bird in this pen laid 255 eggs, which is equivalent to 295 for the 52 weeks, an exceptionally good performance, and one which may possibly be a South African record.

The test has demonstrated the fact that eggs can be produced at all

periods of the year with ordinary methods of feeding and treatment such as can be followed by anyone, and we feel that the very gratifying result will stimulate egg production in this country. Another competition to last 48 weeks, in which heavy and light breeds are represented, is in progress, and as before periodical reports will be published in the various newspapers and this *Journal*.

“**Loledza**” (*Pretrea zanguibarica*, I. Gay).—We have received the following interesting note from the Native Commissioner at Inyati:—“I have been interested by your accounts of the *Pretrea zanguibarica* in the December and February numbers of your *Journal*. This plant is very plentiful in this district, and grows freely in both sandy and red soil, but is not found in black vlei land. I notice that you give the Matabele name of it as ‘Mginga-ginga.’ I have known the plant for many years in various parts of Matabeleland, but always by the name of ‘Nkunzana.’ Since I have seen your article, I have asked a number of natives if they know the name ‘Mginga-ginga,’ but so far have not been able to find one who does. It would therefore appear that its most usual appellation in Matabeleland is ‘Nkunzana.’ Locally the natives use the leaves of the plant, in the green state, as an emollient for washing their bodies and clothes, and assert that it is very effective for these purposes. It is also used as an enema for young children, in addition to the uses which you have already indicated.”

We have received corroboration of the name “Nkunzana” from a farmer in the Selukwe district, who states that this is the name the Fingoes know the plant by. Any further information that our readers can furnish us with regard to this plant will be much appreciated.

Native Remedies.—An interesting instance of the efficacy of native remedies came under our notice recently. It appears that a snake, which was discovered in a farmhouse, spat into the eyes of its pursuer before it could be despatched. The irritation set up by the venom was intense, and the farmer, after suffering great pain, next morning consulted a native, who promptly obtained from the veld a root of the wild asparagus which he steeped in hot water. The sufferer bathed his eyes with the infusion, with the result that immediately relief was obtained, and the eyes have suffered no ill effects since.

We submitted these facts to Mr. F. W. FitzSimons, F.Z.S., F.R.M.S., etc., Director of the Port Elizabeth Museum, who sends us the following interesting note:—“The snake in question would be the black-necked cobra (*Naia nigricollis*). Bathing the eyes with hot water with a little carbonate of soda, or a few drops of ammonia or permanganate of potash added to it, would have been just as helpful as the native doctor’s ‘mooti.’ The proper treatment is to bathe the eyes as soon after the occurrence as possible with a very weak solution of permanganate of potash and warm water. Afterwards to drop in some

bland oil such as pure olive oil and exclude the light. The permanganate neutralises the venom, and the oil soothes the irritated mucous surfaces of the eyes."

Canned Meats.—We reproduce in this issue an article taken from the *Imperial Food Journal and Empire Produce News* dealing with the canned meat trade to the British market. The article deals exhaustively with the position in which this trade finds itself at the present time, and has particular reference to the claim which Colonial canned meats have shewn themselves to have on the British consumer in relation to the foreign article. The facts and figures given provide food for thought, and will, we are sure, be of interest to the shareholders of the Rhodesia Meat Packing Co., as will also the statement "... although the canned meat trade is at present languishing, in comparison with the abnormal demand created during the war, yet it is on the whole a bigger thing than it was immediately before the war."

This is the first number of the *Imperial Food Journal*, "a monthly review founded to promote inter-empire food commerce." As such we heartily welcome its appearance, and we are sure that our readers will find in its pages matter of considerable interest.

Dip Testing.—As will have been seen from the notice which has appeared in the various newspapers of the Territory, a charge of 5s. per sample will in future be made for testing dipping fluids sent to the Chemical Laboratory of this Department. Samples, accompanied by the necessary remittance, without which no analysis will be made, should be clearly labelled with the name and address of the owner, and directed to the Chemical Laboratory, Department of Agriculture, Salisbury. All farmers' associations have been notified of the change, which took effect from the 1st April. The testing of dipping fluids is now undertaken free of charge by the Cattle Inspectors at the following stations:—Salisbury, Hartley, Macheke, Gatooma, Beatrice, Mazoe, Bindura, Mrewa, Sinoia, Marandellas, Umtali, Rusape, Inyanga, Melsetter, Gwelo, Enkeldoorn, Que Que, Umvuma, Selukwe, Victoria, Ndanga, Zimbabwe, Bulawayo, Plumtree, Kezi (P.O. Antelope), Fort Usher, Essexvale, Gwanda, West Nicholson, Belingwe, Shabani, Fort Rixon, Inyati, Nyamandhlovu, and Wankie.

Land Settlement.—The Director of Land Settlement has notified that the present system of granting land under Permit of Occupation has been discontinued, and that the following system now obtains in lieu, viz. :—

"Upon approval of an application a grant is made forthwith under title deed, in terms of which the grantee is required, in the event of his not being prepared to pay the purchase price of the farm in full on the

grant being made, to pay down one-twentieth of the purchase price, and to pay the unpaid balance in not more than nineteen consecutive equal annual instalments, plus interest at the rate of seven per centum on the unpaid balance. The grantee is further required to pass a bond in favour of the British South Africa Company, as security for the payment of the balance of the purchase price and interest in the manner mentioned; the bond to be passed simultaneously with the registration of the title deed, and all expenses in this connection to be borne by the grantee.

"Copies of the respective forms of title deed applicable to land situated on, or off, the Gold Belt, setting out the full conditions attaching to grants of land, together with a copy of the mortgage bond, can be obtained on application to the Director of Land Settlement."

Rhodesian Flora.—We acknowledge with deep gratitude a donation by Mrs. Barnet, Bonongwe Estate, Marandellas, of a large collection of water colour paintings of the better known of our wild flowers. The drawings are almost entirely life size, and will be a valuable adjunct to our herbarium collection. Arrangements are being made to enable the drawings to be adequately displayed at the offices of the Department.

Estimate of the Maize Crop.—From information collected by the Statistician the production of European grown maize in Southern Rhodesia for the season 1920-21 is forecasted at one million bags of 203 lbs. from 182,500 acres. More precise estimates will be available later in the season. The quantity of European grown maize for internal consumption and general purposes is placed at 450,000 bags.

Farmers' Congress.—The Annual Congress of the Rhodesia Agricultural Union was held at Bulawayo on 17th, 18th and 19th of March. A very wide range of subjects was embraced in the agenda, and the debates in general were of a high order, constructive and thoughtful, though occasionally vehement. The daily press have furnished reports of the discussions, and no doubt the full debates will be read with interest in the report of proceedings when published.

The President, Mr. C. S. Jobling, whom we may congratulate on his unanimous election for the second year of office, delivered an address on the agricultural subjects of the day, covering in a very masterly way the whole ground, and correctly expressing the views thereon of a great majority of the farmers of this country.

The organisation of the farmers in this country through a number of associations, all associated with the Agricultural Union, should tend to strengthen the opportunities for expressing through one channel the considered opinions of the whole community. A decision to withdraw the representation of the Agricultural Union on the Railway Conference

is a step which may have far reaching consequences. The debates on railway questions, veterinary matters and mining rights were acrimonious, but brought to light many arguments, and must prove of considerable educative value to all concerned. In many other directions there was very useful discussion which will be helpful in advancing the agricultural interests of the country and in giving expression to the views of different sections of the farming community.

The Farmers' Mass Meeting.—In regard to the mass meeting of farmers held recently in Salisbury to protest against the railway rates on maize, full reports have appeared in the press. It will suffice, therefore, here merely to correct certain remarks reported from a speech by Mr. R. L. Gray to the effect that the Director of Agriculture could have put different facts before the Chairman of the Railways. In order to remove misapprehension which may arise from these remarks, the statement is here simply made that the views regarding the cost of production of maize furnished by the Department of Agriculture to Mr. Maguire at his request consisted of a copy of information supplied to the Department of Mines and Industries of the Union Government six weeks previously, and therefore before the date of Mr. Maguire's visit, and long before the mass meeting was convened. These facts dispose of the suggestion contained in the immediate context of the speech referred to.

Vaccine.

The Government Veterinary Bacteriologist states that complaints have been made that the quantity of vaccine issued is less than stated. As standardised measures are used in dispensing these vaccines, these statements have been investigated, and it has on more than one occasion been found that the syringes used by the operator are incorrectly graduated.

Citrus Industry.

REPORT ON VISIT TO CALIFORNIA.

By A. G. TURNER, Citrus Adviser.

In accordance with instructions received I proceeded to America at the end of October for the purpose of touring California to make general observations on the citrus industry in that State, and particularly the progress and improvements developed in the last twenty years, previous to which time I had lived in California for some eight years.

At this time of the year, early November, there was very little in the way of Californian oranges on the eastern markets except the tail end of Valencias, which were selling from 5 to 10 dollars a box. There was, however, a considerable amount of Florida grapefruit and Parson Brown oranges being sold. It is recognised that Florida grapefruit is of better quality than Californian; in fact, Californian shippers do not attempt to compete to any extent in this fruit with Florida, the greater part of the Californian crop of grapefruit being disposed of on the Pacific Coast and Middle West States.

In making a comparison between Florida and West Indian grapefruit which I saw on the New York markets and that grown in Rhodesia, the latter is undoubtedly inferior. I may say that I have never advocated the planting of grapefruit extensively in Rhodesia, and I feel now, more than ever, doubtful if we shall succeed in growing a really first class grapefruit in Rhodesia. The climatic conditions required for growing this fruit as a fine article do not prevail with us, and I consider for the present, at any rate, it would be unwise to extend any plantations of this fruit.

The Californian Valencia oranges were a fine commercial article, being good fruit well put up, which would sell at top prices anywhere in the world. In this respect I may fairly say that Rhodesian and South African Valencias, which I saw arriving in England before I left for America, compared very favourably with these Californians, and I think, considering the early stage at which we have yet arrived in the citrus industry, this is creditable. I would remark here that Rhodesia is not known as a separate entity from the Union of South Africa in Europe and America, all consignments shipped from the port of Capetown being known as Cape or South African fruit.

I proceeded from New York to Washington, D.C., where I called on the Secretary for Agriculture and presented my letters of introduction. The Secretary for Agriculture was not in office, and in his absence I had

an interview with Dr. H. F. Kellermann, associate chief, Bureau of Plant Industry, U.S. Department of Agriculture, with whom I discussed my proposed Californian tour, and was given a number of letters of introduction to people interested in the citrus industry in California. Dr. Kellermann was keenly interested in our citrus development. I had a number of orange leaf and twig specimens which I had collected in Rhodesia, showing various kinds of leaf spotting, and these he advised me to take to the Citrus experiment station at Riverside, California, for determination.

With regard to the possibility of importing Rhodesian oranges into U.S.A., I explained our position as regards citrus canker, on account of which disease there exists an embargo on South African oranges into U.S.A. Dr. Kellermann is a member of a board of five who would adjudicate on any matter of this sort, and I discussed the question of importing Rhodesian oranges into U.S.A. He informed me that personally he would not object, and he was of opinion that the other members of the board would concur, provided we had a distinctive mark to show place of origin, so that there could be no possibility of fruit from South African canker areas getting in. I do not feel that any advantage is to be gained at present in attempting to make use of the American markets while the English and European markets can absorb more fruit than we can supply from South Africa, but opportunities might occur at certain times of the year when it would be advantageous to send over consignments of oranges.

With a view to future possibilities, it would be a decided step forward to be the first in the market, provided only first class stuff were sent, in order to be sure of a good reception in a country where oranges are more critically considered on the markets than in England.

From Washington I proceeded direct to California, where I visited the main Northern, Central and Southern citrus sections. Northern sections are a little ahead of Central in maturing oranges, which in turn are a few weeks in advance of Southern California. The acreage under citrus fruits in Northern sections is about 10,000, while Central sections are small in comparison with Southern, being approximately 45,000 and 190,000 acres respectively.

It may be said that practically all plantings of oranges in California are of two main varieties, Navels and Valencias, which at the present time are fairly evenly divided in point of acreage, but there are indications that Valencias in recent years have been planted in greater numbers than Navels. It is interesting to note that in about 1860 there is said to have been some 25,000 orange trees in the whole State of California of different varieties, but mostly budded seedlings. It appears that in some sections planting has gone ahead of the possibilities for economical development of irrigation water. It is claimed that at least twenty acre inches of irrigation water per acre is required for all citrus trees between April and November inclusive, and any district where this amount is not available is probably over-planted. Where summer (dry season) cover crops are to be grown this minimum requirement must be increased to nearer thirty inches.

According to reliable authority the bearing acreage of oranges in California has only slightly increased during the last few years, while the total acreage of bearing and non-bearing oranges has actually decreased. Towns have been built upon one-time orchard land, and sections have been converted from citrus into general farming districts on account of cold hazard, rising water table or other unfavourable circumstances. New plantings have not quite kept pace with the elimination of badly chosen sites.

The approximate figures given in acres for the whole State last year are as follows:—Oranges—bearing, 133,000, non-bearing, 50,000; lemons—bearing, 33,000, non-bearing, 17,000; grapefruit—bearing, 6,000, non-bearing, 7,000; a total of all citrus trees planted of 246,000 acres.

It must be remembered in any comparison of conditions that Rhodesia lies between latitudes 16° and 22° south, and our rainfall, which occurs in the summer months, averages about 25 to 30 inches, mainly over a period of four or five months (November to March inclusive), whereas California is between latitudes 30° to 35° north. The rain falls there in the winter months, and averages about 8 to 15 inches over a period of five to six months (October to March), so that what may be perfectly sound principle in the one country may not be effective in a country of almost opposite climatic conditions. I wish to make this clear at this juncture, so as to avoid future reference with regard to some cultural and other methods in vogue in the two countries.

The cost of production of oranges in California has been gradually increasing in recent years, as is apparent from the following figures, compiled by a member of the California Citrus Experiment Station. In 1913-14 harvest costs per box were 50 cents, and in 1918-19 these had increased to 85 cents, while field costs per acre in 1913-14 were 136 dollars, and in 1918-19 had reached 175 dollars. This has, of course, been in keeping with all other industries, and it is anticipated the increase last year was greater still, but complete figures have not yet been worked out.

The same authority gives the average returns per acre for the last six years' average as a net profit of 90 dollars per acre for oranges and 60 dollars for lemons. Because of the very considerable risk that is attached to such an agricultural pursuit as fruit growing, where the trees are not always a permanent investment, but must from time to time be replaced, it would seem that 10 per cent. on an investment is not an exorbitant return. The figures for the past six years on this basis show an average value of 600 dollars per acre for bearing lemon orchards, and 900 dollars per acre for bearing orange orchards. It is, of course, true that there is much land which shows a larger net return than this, but in order to offset such properties there must be other groves which show a net return equally below the average. It may be said that a competent grower, with a well-chosen orchard, may safely expect a yield 50 per cent. better than the average of the industry. Such a yield would have given an average net return over the past six years of 200 dollars per acre on either oranges or lemons.

The output of citrus fruit for the past year is very clearly given in the annual report of the General Manager of the California Fruit

Growers' Exchange for the year ending 31st August, 1920:—"Satisfactory prices were received for the short orange crop, but because of cool weather, foreign competition as a result of the rates of Italian exchange and other factors, the lemon market was very unsatisfactory during the summer months. A shortage of cars and frequent strikes interfered with distribution, and an increase in transportation rates added an expense of nearly 6,000,000 dollars to the industry.

"During the year ending 31st August, 1920, the members of the California Fruit Growers' Exchange shipped 12,144,964 boxes of oranges, 226,226 boxes of grapefruit, and 3,452,534 boxes of lemons, making an aggregate of 15,823,764 boxes, or 34,461 carloads. The total shipments of citrus fruits from the State were 38,077 carloads of oranges and grapefruit, and 8,680 carloads of lemons, making a total of 46,757 carloads. The returns f.o.b. cars California, for the fruit shipped through the Exchange, including the estimated value of the cars yet unsold, will be approximately 59,221,329 dollars. Using the Exchange returns as a basis, the returns to California for the total crop of 1919-20, including the portion of the 1919 Valencia crop which was sold after 31st August, will approximate 81,200,000 dollars, representing a delivered value in the wholesale markets of 106,600,000 dollars, including 25,400,000 dollars of freight and refrigeration charges. The retail dealer paid approximately 121,100,000 dollars for the fruit, and the consumer paid 166,000,000 dollars. The gross margin of the wholesale trade in handling California citrus fruits represents an average of about 12 per cent. of its selling price, while the average gross margin of the retail dealer represents an average of 27 per cent. of the retailer's selling price.

"The Exchange shipments for the twelve months' period represent 73.7 per cent. of the total shipment of citrus fruits from California, which is an increase of approximately 1.4 per cent. over the preceding year. The Exchange membership has increased during the past year from 10,000 to 10,500 growers, and the combined number of shippers' associations and district exchanges belonging to the organisation has increased from 216 to 219.

"During the past year, the losses from bad debts and uncollected bills amounted to 435.83 dollars, representing $\frac{3}{4000}$ of 1 per cent. of the f.o.b. value of the fruit. There has been returned to California through the Exchange 376,000,000 dollars during the last 17 years. The losses of all kinds during this period have been approximately 8,775 dollars, or $\frac{9}{4000}$ of 1 per cent. of the f.o.b. returns.

"The Exchange service, exclusive of advertising, cost an average of 5.51 cents per box in 1919-20. This service includes the maintenance of all Exchange departments, the salaries and expenses of agents, brokerages, the daily market news service, the collection of claims, legal expenses, the California Citrus League, the field service of the Exchange—including the development of membership, the organisation of new associations, the industrial relations department, the Exchange research laboratory, and all other operating costs.

"The average cost of the district exchanges has been 1.12 cents per box, making the total average operating cost of the Exchange marketing

service 6.63 cents per box, or 1.35 per cent. of the delivered value of the fruit and 1.77 per cent. of the f.o.b. returns.

“As a result of the increased costs of doing business, the operating costs of the Exchange increased 1.25 cents per box during the year, yet, because of the increased volume of fruit marketed through the Exchange, the operating cost per box is less than it was ten years ago.

“There has also been expended for advertising and sales promotion—including dealer service and a campaign to increase the sale of oranges and lemon drinks—and for other features handled by the advertising department, 2½ cents per box for oranges and grapefruit and 6 cents per box for lemons, in addition to the operating cost. The amount expended per box for lemon advertising and sales promotion was increased 2 cents over the cost of 1918 on account of the rapidly increasing crop and the most severe competition of Italian lemons. This makes a total average cost—including both the Exchange service and advertising—of 2.01 per cent. of the delivered value of the fruit, and is, so far as we know, the lowest marketing cost of any perishable food product in America.”

The California Fruit Growers' Exchange are now doing about 75 per cent. of the marketing of oranges, but some big independent grower-shipper undertakings, who have all their own full equipment, do their own packing and marketing. These independent houses which have their own equipment consider they can do the whole business cheaper than by becoming members of the Exchange, but although these concerns work separately from the Exchange, there is no animosity.

I have recollections of frequent “Red Ink” returns for fruit when I first went to California in 1892 and several succeeding years. At this time practically all fruit was handled by houses owned by individuals who either consigned the fruit to the various eastern and other distant markets on commission, or occasionally bought outright at the packing house. There were large quantities of fruit to ship, but account sales were very frequently unsatisfactory, and on occasions the larger the crop a grower had, the more he was indebted to his packing house at the end of the season. As a consequence these unsuccessful attempts to market large crops induced some growers to commence local co-operative packing houses for their mutual protection and to provide better packing facilities. These concerns were in many ways successful, but it was felt that the whole citrus industry, as far as possible, should be controlled by one large exchange, and in 1905 the California Fruit Growers' Exchange was incorporated.

Mr. G. H. Powell, General Manager of the California Fruit Growers' Exchange, in speaking of distribution and costs, made the following remarks:—“The first step in making a reasonable cost of distribution possible is the organisation of producers, because only in that way can a large volume of standardised foodstuffs be provided and sold. Then, if the conditions are favourable, the producers' organisation can sell its products in the primary markets at a lower expense than is at present possible for the small individual buyer or the shippers' agents. This creates a dependable supply upon which the wholesale and retail trade can rely and specialise, and reduces the gross margin of profit.

“By way of illustration:—Twenty-five years ago it cost the unorganised citrus fruit growers of California from 10 to 15 per cent. or more to have their fruit sold to the jobbers. At the present time it costs the individual grower from 7 to 10 per cent. to sell it in the same manner. One producers’ organisation, with eleven thousand members, distributes and sells through its own agents seventy-five million dollars worth of citrus fruit annually to the jobbers of the United States and Canada at a total marketing cost of less than $1\frac{1}{2}$ per cent. of its delivered value. It furnishes regular supplies of uniformly graded fruit to the different markets, and the jobbers and retail dealer are selling this fruit at gross margins not much larger than those applied to the sale of non-perishable foodstuffs at the lowest gross margins, so far as we know, that are applied to any other fruit crop.”

The functions of the Exchange are numerous, and new avenues of usefulness are opened out from time to time. The Exchange is a democratic organisation, in which the growers exercise control over all matters; weekly meetings of the directors, held at the Central Exchange Headquarters in Los Angeles, can be attended by any member. The General Manager describes the California Fruit Growers’ Exchange as an organisation which acts as a clearing house in providing the facilities through which some eleven thousand growers distribute and market their fruit. There are three foundation stones in the Exchange system: the local association of growers, the district exchanges and the central exchange. The local associations, the district exchanges and the central or California Fruit Growers’ Exchange are organised and managed by the growers on a non-profit co-operative basis; each operates at cost, and each distributes the entire net proceeds to the growers after operating expenses are deducted.

There are now some 220 local associations which come into 19 district exchanges. The managers of these district exchanges represent their districts at the central exchange as directors. The (Central or) California Fruit Growers’ Exchange is managed by a board of these 19 directors through a general manager. The Exchange maintains managers in all the large cities of the United States and Canada, who represent the Exchange in their own districts and are employed exclusively as salaried agents, engaged only in the sale of fruit, in the development of markets, and in handling the business of the Exchange in their own districts.

The Fruit Growers’ Supply Co., which is owned and operated by members of the California Fruit Growers’ Exchange, was organised in 1907, for the purpose of purchasing the orchard and packing house supplies for its members. The Fruit Growers’ Supply Co. came into existence through the cost of box shooks being increased by some 70 per cent. in 1906; the growers then realised the necessity for protecting the industry by ensuring a supply at equitable prices. The Fruit Growers’ Supply Co. recently purchased some fifty odd thousand acres of timber land, on which a sawmill and box factory have been constructed, so that they can now provide all their own box shooks, besides selling the better stuff as lumber.

In the annual report of the Manager of the Fruit Growers’ Supply

Co. the following illuminating figures show the large business covered by them:—

“For the year ending 31st August, 1920, the total amount of business transacted was as follows:—

	dollars.
Purchases by members	8,758,222.67
Hilt lumber and merchandise sales	1,078,851.16
	9,837,073.83

This amount is sub-divided as follows:—

Packing House Supplies.

Box shook, including picking boxes, car strips, etc.	4,876,355.98
Tissue wraps	850,124.14
Labels	89,467.48
Nails	138,310.24
Miscellaneous	370,215.81
	6,324,473.65

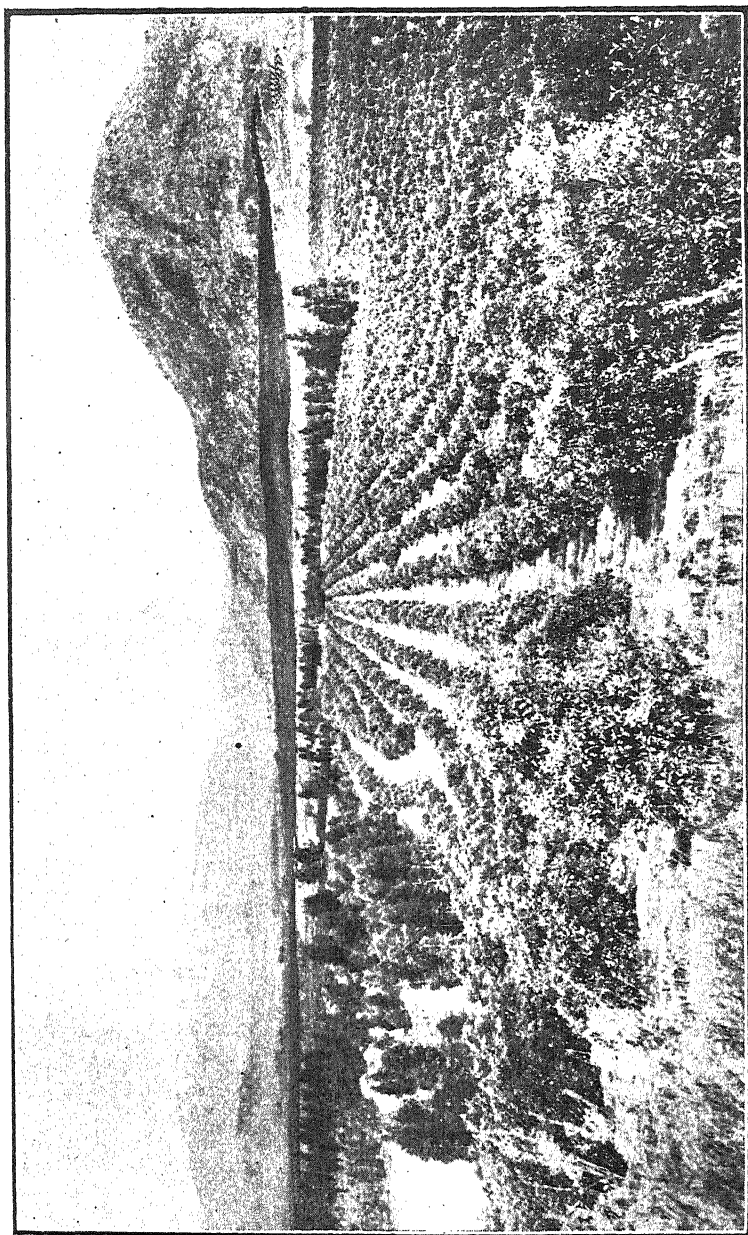
Orchard Supplies.

Covercrop seed	90,912.85
Fumigation supplies	428,892.71
Commercial fertilisers	746,281.15
Manure fertilisers	330,662.52
Spray equipment and supplies	261,654.85
Frost prevention equipment and supplies ...	289,742.58
Miscellaneous supplies	242,673.41
	2,390,820.07
Non-participating purchases	42,928.95

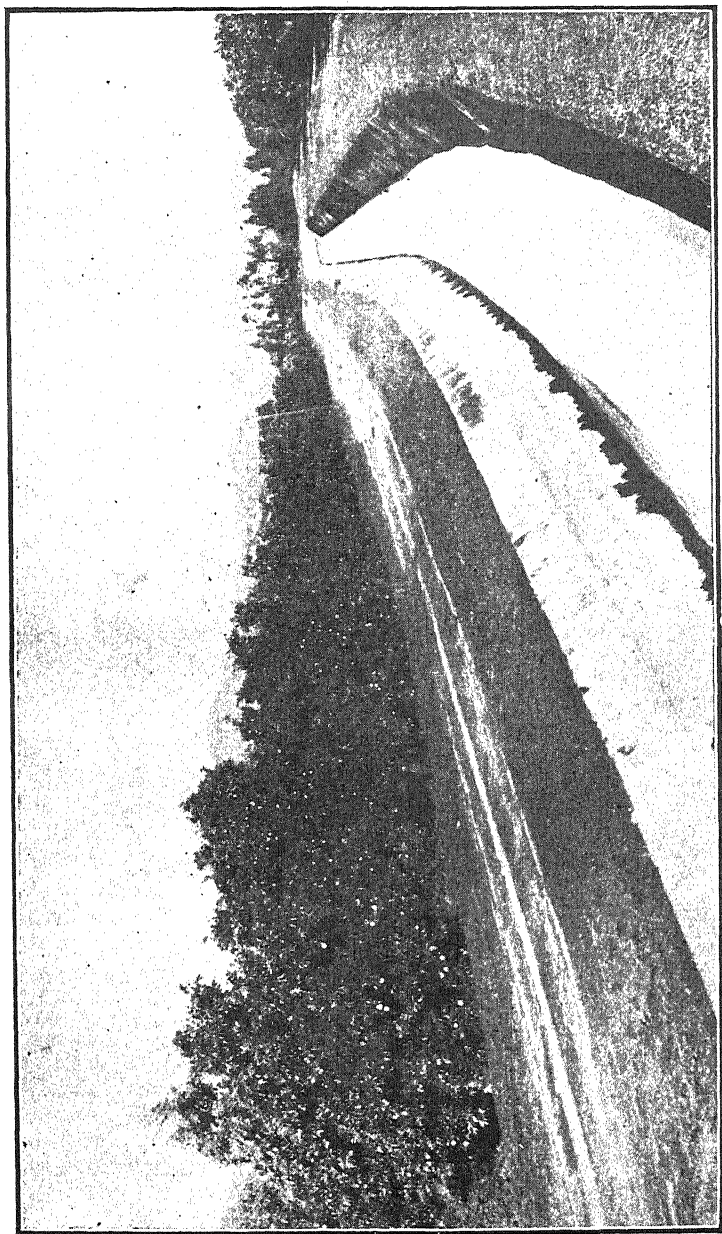
Hilt.

Lumber	725,825.85
Shook	986,111.70
Wood	4,802.12
Store	283,392.12
	2,000,131.79
Less shook to members	921,280.63
Net sales to others	1,078,851.16

“The operating cost for the season was 1.34 dollars for each 100.00 dollars of the total business transacted. This represents an increase of .0374 over the previous year, when the cost was 1.31 dollars per 100.00 dollars of purchases. This slight increase in cost of transacting business is less than that experienced by practically all lines of business, and was largely the result of the general increase in all items of overhead expense, and to the broadened field of usefulness and greater service rendered to its members by the Supply Company.”



Orange Groves near Riverside, California.



Irrigation canal near Riverside, California, showing snow mountains in distance supplying the water.

I was invited to attend a weekly meeting of the district managers of the California Fruit Growers' Exchange in Los Angeles, when an interesting discussion came up on the proposed shipping of citrus fruit from Pacific Coast ports to New York and other parts of the Atlantic *via* Panama Canal. The necessity for enquiring into this matter had been brought about by the excessive rail rates now being charged across the continent. This method of transportation would be somewhat similar to our own South African conditions, and members were considerably interested in what I had to say regarding Rhodesian and South African shipments by cool chamber and ventilated hold. I would say they were not favourably impressed with the idea of using what is known as ventilated hold accommodation, on the same lines as we have been forced to, for lack of sufficient cool chamber accommodation. The opinion was expressed that the conditions of this ventilated hold stowage might be very greatly improved by the installation of an efficient system of fans throughout the ship to allow free ingress and egress of air. It is contended that although this would not necessarily greatly reduce the temperature in these holds, it would greatly improve the conditions by currents of fresh air, and thus clear out the foul stale air which is extremely detrimental to the good carrying of the fruit.

I would remark here that I consider the present system of ventilated hold stowage, as used for oranges from Capetown to Europe, absolutely inefficient and harmful to the future of citrus export from South Africa. The temperatures rise extremely high, and if any bad weather is struck, what little ventilation there is from the hatch gratings is completely shut off by covering the hatches with sails. Wind sails are supposed to be used to assist ventilation, and possibly do assist to some extent, although there is no egress for foul air.

During August, September and October, 1920, I examined several consignments of oranges *ex* Capetown on arrival at Southampton, and was not surprised to find that the fruit coming out of ventilated holds was distinctly warm, wilted, dull in appearance, with a large percentage of waste from blue mould and brown rot. I am convinced that while the present method of ventilated hold stowage is followed there will be great wastage in oranges, however good their condition at time of loading in South Africa, but I do believe that very material improvement could be made in this class of stowage by the introduction of a system of fans.

On one occasion when I was in Covent Garden I was asked by a member of the firm of Messrs. Geo. Monro, Ltd., to look at a consignment of oranges, *ex* Port Elizabeth I believe, that had just arrived. They were a perfect mass of brown rot, and possibly there were 3 per cent. of edible oranges. This gentleman had very little good to say in favour of the average condition of oranges *ex* ventilated holds from South Africa. On the other hand the oranges sent over in cool chambers have been arriving in excellent condition on the whole, with only a small percentage of waste.

At this meeting of directors of the California Fruit Growers' Exchange there were a number of discussions on various problems, and

amongst other items a committee was formed to enquire into (a) the best means of manufacturing fruit juices in powder form and collaborate with Government experts, (b) the best method of making commercial peel from oranges. During the course of this meeting the field manager of the Exchange spoke of the necessity of keeping up the grades according to the regulations of Exchange associations. He stated that oranges altogether too green were being sent in, which in many cases besides being green did not come up to the 8 to 1 test, and that samples of some loads sent into packing houses were not representative of whole loads. He emphasised that this way of doing business was wholly disastrous to the whole industry, whereas if this same fruit had been left on the trees for some weeks to mature, it would often go mainly fancy grade; being green, however, it was not fit for good grades even after gassing or sweating.

The Northern and Central sections of California are mainly planted to Navel oranges, although in recent years considerable planting of Valencias has taken place in Central. The object aimed at in both sections is to move off practically all their Navels before the South commences to ship in quantity; consequently their season is short and the business is a rush. Higher wages are therefore demanded all round by labour, but this is compensated for to some extent by the Navels realising higher prices than they would do later in the season when the bulk of Navels is marketed from the South.

Some years ago it was found that early immature oranges, unfit for consumption, were being shipped out of California to capture early markets, and to obviate this what is known as the 8 to 1 test was brought in under the Fresh Fruit Standardisation Law. The section of this law relating to oranges reads:—"Sec. 9. Oranges shall be deemed properly matured for shipment or sale under the provisions of this Act when the juice contains soluble solids equal to or in excess of eight parts to every part of acid contained in the juice, the acidity of the juice to be calculated as citric acid without water of crystallisation; *provided* that the oranges have attained at least 25 per cent. yellow or orange colour before picking, and oranges which are substantially or at least 70 per cent. coloured at the time of picking shall be deemed properly matured for shipment or sale, irrespective of analysis of the juice. When packed, shipped, delivered for shipment, offered for sale or sold, oranges shall be virtually free from insect and fungus diseases and other serious defects. Oranges shall be considered unfit for shipment when frosted to the extent of endangering the reputation of the citrus industry if shipped. The foregoing provisions shall not apply to shipments of oranges to foreign countries other than the Dominion of Canada, during any season, provided such shipments are made after the first day of November."

All growers are provided with coloured plates, issued by the Office of Standardisation, State Department of Agriculture, Sacramento. One shows a 70 per cent. coloured orange, and the other a 25 per cent. coloured orange. (I have brought some of these coloured plates with me.)

It will be recognised that a 25 per cent. coloured orange is pretty green,

and that even a 70 per cent. one is light coloured. Although they both may have the necessary sugar content according to the law, the poor colour militates against the sale price, and in order to overcome this a great deal of this early fruit is subjected to a gas treatment in closed chambers for a period varying from two to three days. In this way an even, well-coloured orange is produced. This treatment serves the dual purpose of colouring the fruit and wilting it so that it is in good pliable condition for packing. Fruit that is not treated in this way is liable to reach market with an uneven and anæmic colour, which discounts the value of the fruit in the markets. This colouring process is fairly simple. A paraffin stove is placed in a closed chamber, and in order to generate gas without great heat a tin disc is placed on the burner for the purpose of accentuating the volume of gas produced. Gas is now recognised to be more effective in colouring the fruit than heat, a temperature of about 70 deg. F. being maintained, although until the last few years it was believed greater heat was required.

On account of the danger from fire with the old method of gassing fruit for colour and to comply with present insurance risks, the gassing plants are now situated in separate chambers, away from packing houses, and usually across the road. The gas is blown by motor fans through a galvanised iron tunnel or pipe into the sweating or gassing chambers in basements or on the floors of the packing houses. Blue flame stoves stripped are employed for generating the gas, paraffin being used. The gassing lasts for 24 to 72 hours, according to the maturity of the fruit, which is then ready for grading, sizing and packing. The only test to determine the strength of the gas appears to be to what extent the eyes are affected upon entering and remaining in the chamber.

Every device that will obviate any damage to fruit is made use of in picking and packing; for instance, the cleats of field boxes are rounded off so that there is no sharp edge for the fruit to come in contact with when emptied, while triangular pieces of wood are nailed into the four corners of this box to avoid sharp angles, and also to add to the strength of the box. No strapping is used, as it becomes loose, and so would be a danger to handle; the life of these boxes is reckoned to be about eight years. In many packing houses the ends and partitions of the orange box are bevelled, and where this is not done, slips of cardboard are used to prevent fruit being cut on the sharp square edges when put under the nailing press, as it was found on investigation by the California Fruit Growers' Exchange some years ago, that this was one of the main causes of oranges being in wasty condition on arrival in distant markets. The greatest care is also demanded of pickers, graders and packers, who are obliged to wear cotton gloves for handling the fruit. The clippers mostly used now have rounded points, and all oranges are clipped so that the stem is carefully cut off short and smooth to prevent any possible damage by abrasion of the skin when one fruit comes in contact with another. Cloth picking bags are carried over the shoulder and are adjustable in capacity. The bottom of the bag is open and fixed with a flap which folds up and fastens with snaps and rings, so that when the bag is full these can be unfastened and the fruit emptied carefully into the field box (lug-box), which must be kept clean,

all dirt, leaves and sticks being emptied out before any fruit is placed in it.

All packing houses in California are built on the railroads, and are fitted out with elaborate machinery and arrangements for handling the fruit. The buildings are usually designed with basements covering the whole area, while the floor on which the packing takes place is fixed at a convenient level for off-loading from orchard trucks and loading into railroad cars. The basements are used for storing box-shooks, making up boxes and stacking up the oranges in lug-boxes as received from growers.

The fruit on arriving at the packing house by trolley in lug-boxes (field boxes for use in orchard) is received on a platform and conveyed from there on a belt or roller conveyor to the basement, where they are stacked up in tiers, and remain there for a few days until ready for packing.

It is not usual for oranges in California to arrive sufficiently clean at the packing house to be packed without brushing and sometimes washing. If the fruit is only dusty it is run through revolving dry roller brushes. If, however, it requires washing it is run through a tank in which the water is disinfected, and then conveyed through an air-blast dryer.

The fruit is then conveyed on broad moving belts before the graders, who take into consideration colour, blemishes, smoothness of skin and shape. The oranges are graded into three grades, fancy, choice and standard, and any fruit not suitable for packing at all is rated as culls and disposed of in various ways. The graders place the fruit on one of three moving belts according to its grade, when it is conveyed to the sizing machines, and each size is delivered into a separate bin, which is padded on sides and bottom, and has movable sides, so as to allow for adjustment of capacity. In large houses separate sizing machines are used for each grade, but in smaller houses, which may only contain two sizes, one whole machine would size fancy grade, while one side of the other machine might grade choice, standard being delivered through the other side.

Women are mostly employed as packers, but men are also used, all packers being obliged to use gloves. The graders also wear gloves. The packers' benches are set beside the sizing bins, and each fruit, as it is wrapped in tissue paper, is placed in the box by the packer. Each size of orange has its own and correct order of arrangement in the box, and the size is designated in the house and on the market, not by the diameter of each fruit, but by the number required to fill the box. The sizes used are the same as we use in South Africa. When the box is packed it is placed on an automatic conveyor and taken to the nailing press, where the covers are forced down and nailed, considerable pressure being exerted, as it is usual to have a very high pack. The packed box is then conveyed to the pre-cooling room or direct into the railroad car.

Fruit cars are not iced during winter months. The floor of the car is covered with a rack about 3 inches high to assist ventilation, on which the boxes are stacked. The usual carload is 462 boxes, laid out in two

tiers, seven across the car and thirty-three lengthways. The boxes are set on their ends with an air space running lengthways of the car. Each tier of boxes is held together by $1\frac{1}{2}$ inch strips nailed to each box across the car. Sometimes a car is decked, *i.e.*, an additional layer of boxes is set on their sides, on top, throughout the car. The two ends of a car of oranges are packed first, the doors being in the middle. As the car is being loaded a large car-squeeze is used to press the tiers of boxes towards the ends of the car, and before the last tiers can be inserted in the centre of the car, a smaller squeeze is used, which opens up just sufficient space for a box to be forced in; this keeps the load absolutely intact during its long journey of perhaps several thousand miles.

A comparatively new system of wrapping and packing oranges has been tried in some citrus sections, which does away with the individually wrapped fruit, but it has not yet been used extensively. The separator-wrap, which is a sheet of pliable cardboard the size of the box, which was originally only perforated with radial cuts in regular formation, has been much improved this last season by deeply cupping the cuts, making the packing nearly automatic. It does not entirely wrap the fruit, but protects and holds it in place and shows the packer exactly where to put the fruit. Shipments to eastern markets and Canada have shown the pack to have practical value. A flat pack was originally intended by the designer, who claimed the separator-wrap held the fruit in place sufficiently tight to prevent damage, but it has been shown by actual experience that a liberal bulge is essential with this pack, as well as in the regular ordinary method of packing. I would emphasise here, in view of the recent discussions by authorities in the Union of South Africa on this subject, who claim the bulge is detrimental to the good carrying of oranges, that it is pointed out in California, with both the ordinary individually wrapped system and the separator-wrap pack, that the bulge pack is not by any means a demand of the buyer for more fruit, but for the purpose of holding the pack absolutely tight in transit and the individual pieces of fruit immovable under the constant jar while on the cars. This is a vital necessity.

It is estimated that the present average cost of a box of oranges, including all charges incidental to picking and packing, is approximately 1.10 dollars. This includes picking and hauling to packing house 25 cents, and all packing house charges, *viz.*, box packing, wrapping material, grading, sizing, nailing up, stencilling and loading in cars, 85 cents, which includes an overhead charge of 5 cents. Rail freight to eastern centres is 1.55 dollars per case. To these costs must be added the selling charges, making a total of about 2.85 dollars per box for the fruit landed at the eastern markets, and which must be allowed for before the grower gets anything for his fruit. At the end of November fancy grade oranges were selling at 4.50 dollars per box and choice grade for 4 dollars per box *f.o.b.* The average prices for the season would probably be lower than these figures.

I inspected packing house equipment which has been ordered for the British South Africa Company's citrus estates from the Parker Machine Works, Riverside, California, and it is hoped this machinery will arrive in Rhodesia at an early date.

For the purpose of seeing as much of the citrus industry as possible in the time at my disposal, I visited a large number of orchards and packing houses in the three citrus belts. In Northern California I went around Penryn, where the first Navels of the season were being packed. The output from around there is quite small. At Oroville, Butte County, I attended an orange and olive show, and also inspected a number of orchards and packing houses, which were all busy with early Navels. The show was held in November by reason of the fact that citrus fruits and olives were being harvested, and commercial displays of oranges and olives were possible. In addition to these fruits there were on display avocados, guavas, other semi-tropical fruits and apples from every part of Butte County. The apples shown here, which were grown at 2,000 feet elevation, were particularly good, especially the following varieties:—Arkansas Black, Delicious, Rome Beauty, Black Ben Davis, York Imperial, Black Twig and Gano. The growers here realise they have a valuable asset in being able to get into the markets with Navel oranges a month or six weeks ahead of Southern California. The area around here planted to oranges is not large, and is apparently restricted by water supply. In some sections of Butte County orange trees have been seriously affected by citrus blast; this trouble has been going on for a number of years, but does not appear to have been combatted or controlled until recent years. The soil derived from lava formation is rather shallow, being about 2 to 4 feet of fairly heavy red soil underlain by coarse gravel, and orchards appear to have been considerably neglected as regards fertilisers and water. It would seem that citrus blast is worse where trees have not had good attention. Oranges being picked were well coloured and sweet for the season of year, but were small on the whole, probably due to lack of water and fertiliser; in some sections, however, orchards have been given more attention, and where manure has been available it has been applied at about 200 lbs. per tree plus a small amount of commercial fertiliser. Growers admit they have not treated their trees as well as they should have done in the past, but are mostly trying to recover them by better care all round. Farmyard manure is hard to get, but fair quantities of sheep manure are obtainable at times, and, when available, are used. The soil around here is claimed to contain potash in good proportions, but this is mostly not available as plant food except when lime is used. Growers here depend largely on burr clover (an indigenous plant) for a cover crop, although some are using other clovers, vetches, beans and peas. I was informed that some growers reckon to use 24 miners' inches of water (50 miners' inches equal approximately 1 cubic foot per second) for 48 hours run on five acres of oranges, usually about every four weeks. Some growers use cement standpipe distributories, others open cement lined flumes and plain earth ditches. Orchards which have been well cared for show up very distinctly against others which have been neglected in any way. In this district it is claimed that orange trees are more or less dormant from December to March, and thus are in harder condition to withstand cold than orchards in Southern California. The oranges are all marketed before Christmas. Several large developments are projected, and it is proposed to put some 15,000 acres under a new irrigation scheme as storage dam, from which it is anti-

culated water will cost about 5.00 dollars per acre per annum. Land undeveloped is held at 75.00 dollars to 250.00 dollars per acre.

Several packing houses during my visit were packing early Navels, and as it was desired to rush the fruit off as soon as possible, oranges were being packed practically as soon as they arrived from the orchards. The manager of one house, however, informed me that he would rather have the fruit wilted for two or three days in the packing house before packing, as fresh picked oranges make a very stiff pack. Packers here were being paid 7 cents a box and double tickets for small size fruit, packing house men, truckers, carloaders, etc., 60 cents per hour. Boxes were made by contract at 2.30 dollars per 100, and box shook cost 33.00 dollars per 100.

Near Sacramento, the capital of California, there is a small citrus area at Fair Oaks, and being in the vicinity I paid a short visit there. The Navels here were mostly well coloured for this early season, being about the same as ours in Rhodesia in mid to end April, when consignments were despatched last season from Rhodesia to Europe. There is an association packing house in the centre of this district, which is open rolling country, but so far as I could judge there is not really a sufficient quantity of water for the present plantings, apart from any extensions which may be proposed. The land, which was originally used for raising wheat and oats, has a hard pan at two to three feet below the surface, which necessitates blasting previous to planting. The district was bought up from original owners some years ago by various agents, and sales are now declared at 200.00 to 300.00 dollars per acre for cleared land, which I was told locally was considered too high a figure to pay for such land; in addition, water will cost about 75 dollars per acre.

These Northern Sections are about latitude 35 deg. N., Central about 33 deg. N., and Southern about 30 deg. N., so that it will be seen that there is a variation of several hundred miles north and south between the three citrus sections of California. In Tulare County, Central California, there is an approximate acreage of 45,000 citrus trees. Lindsay is the largest centre for early Navel oranges, and also claims to be the biggest individual shipping centre in California. A large amount of these early Navels, although up to the 8 to 1 test, are rather green, which necessitates the fruit being sweated or gassed to bring on the colour. All packing houses in Lindsay-Porterville area were busy with early Navels, the fruit being of more uniform size and better grade than in Northern Sections. In some cases the separator-wrap system of packing was being used for several sizes, but so far it has not been regularly adopted.

Tulare County claims to be some four weeks ahead of most of the south, and has a great advantage in this respect, as it practically controls the markets for early Navels, comparatively small consignments only coming from Northern California.

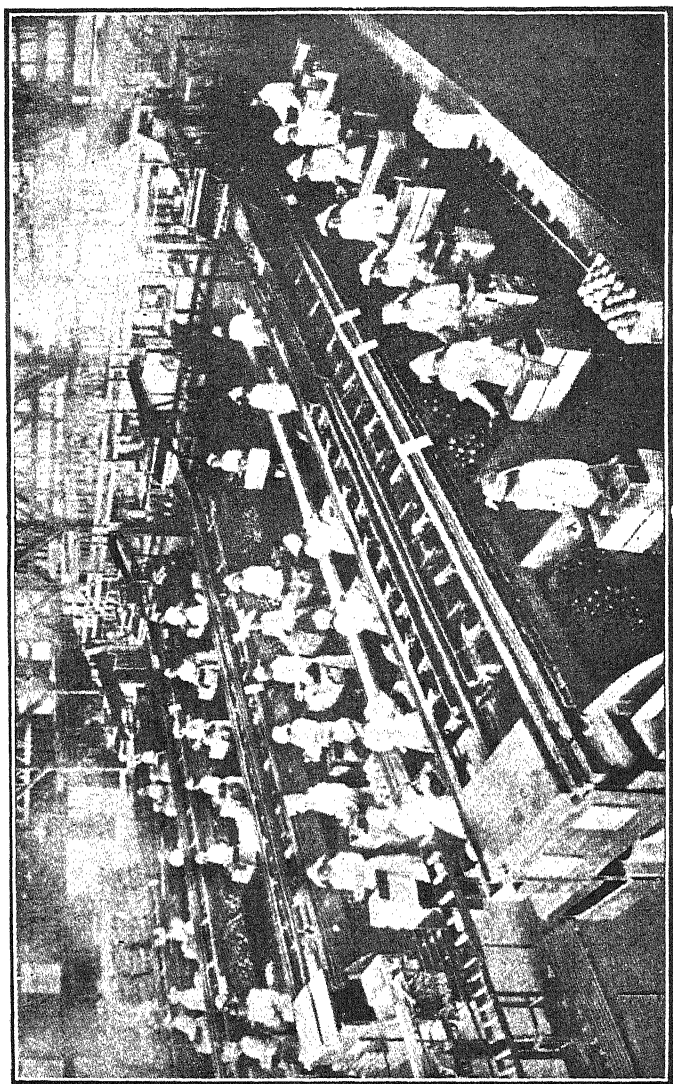
I was impressed with the fact that packing house methods have not altered greatly in recent years, except that various mechanical improvements are now in use. Packing house costs were large; packers were

getting 7 cents per box and double tickets for small sizes, truckers, etc., 60 cents per hour, car loaders 65 cents per hour. Box makers contract at 2.30 dollars per 100, box shook costs 33.00 dollars per 100, wrapping paper 16 to 17 cents per box—only one end of the box now has the label or brand. On account of the rush business with early Navels in Central California, many of the packing houses here are not as particular as in other parts with regard to the packing of the fruit. No attempt is made to twist wrappers on the orange, which is merely thrown at the wrapper and placed in the box, but the top layer is expected to be better wrapped, and in some cases the design on wrappers is placed so as to show through the side spaces of the box. Packers get through as many as 150 to 180 boxes per 10 hour day, which is about double the quantity expected or even allowed in many southern houses. In extra fancy pack, fancy paper curtains are used, but to no great extent on account of the present cost of all such extras. All packers wear one cotton glove, some two; others one glove and a rubber finger-stall for picking up the paper wrappers.

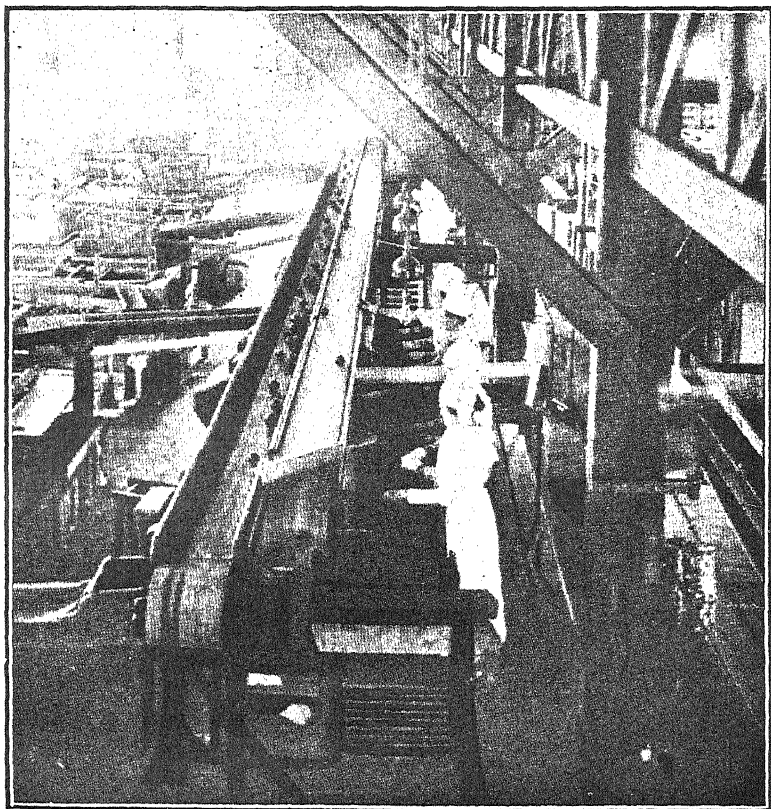
I visited some parts, with a view to investigating certain soil conditions existing there, which are to some extent similar to certain parts of Rhodesia, in that the soils are heavy adobe, and orange trees have suffered from root-rot and scaly bark. These adobe soils are of a stiff clay character, and very difficult to handle. They, however, produce strong trees, with fruit of very good quality, when the trees are kept going under good conditions. So far as is known at present—and various methods are being tested all the time—the best way of combatting root trouble in heavy clay adobe soil is to irrigate lightly at shorter periods than is usual on other soils, allow the ground to crack naturally between irrigations and so aerate. It is admitted that at times cracks may become wide and tear the roots, but it is contended that torn roots with aeration are likely to do less harm to the trees than rotting roots without aeration. It seems advisable also to leave the land in the plough after fall ploughing and do as little compacting of the soil in the way of harrowing and cultivating as possible.

In severe cases of root rot resort has been had to cutting away all affected roots and painting over wounds with Bordeaux Paste and afterwards with asphalt paint. Seedlings previously planted around and a little way from the stem of the tree when grown sufficiently large are inarched into the main stem, by which means new roots are formed to take the place of those cut out. This method of creating a new root system has not, so far as I could learn, ever been done on a very extensive scale, and I doubt if it would be economical to do so except under extraordinary circumstances.

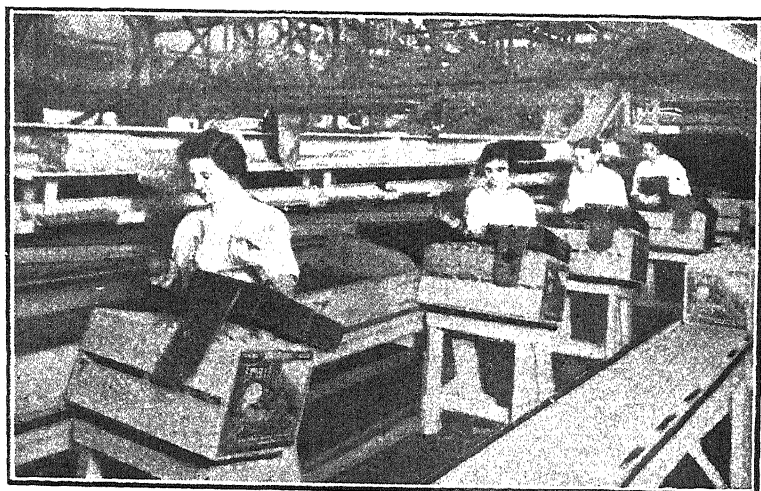
With regard to scaly bark, the most satisfactory method of control has been to cut out all affected parts to clean wood, paint over immediately with Bordeaux Paste and later on with asphalt or other good paint. In some cases, where the wound has been large it has been found, to assist the healing process, that it pays to inarch over the wound. I visited these orchards with an officer of the citrus experiment station who has been carrying out experiments on the treatment of these adobe soils, and the opinions expressed above were mostly gained from this source.



Interior of a packing house in California.



Sorting and grading table.



Packing the oranges.

I visited various other orchards with the owners, amongst them a typical hillside property of some 250 acres, a large part of which is a stony hill, but 120 acres is planted to oranges and some grapefruit on a stiff adobe soil. Many trees have gone in from root trouble. Up to two years ago practically no fertiliser of any sort had been used; since then the trees have recovered very considerably in general health and yield, and it is thought that had the previous management followed a policy of thorough fertilising in conjunction with good irrigation, the trees would not have been liable to any great trouble. This adobe soil in its natural condition cracks up during the hot dry summer, and thus becomes aerated, but when continually cultivated and irrigated this condition never occurs, and the condition is that insufficient air and moisture get down to the roots of orange trees in this soil; in fact, the cracking of the soil which happens under natural conditions to aerate the soil is done away with by irrigation water filling up these cracks in dry season. This clogs up the soil so that roots have no chance to throw out fine fibrous roots, and the smaller roots that do grow actually become almost flattened; further, no water, rain or artificial, eventually gets down into the soil. It was found that a hard pan had been formed from ploughing with disc ploughs through which it was impossible to get any water, so a sub-soiler was set to work to plough, one furrow only, down the centres of tree rows along the contour of the hill; this allowed water and air to get down into the soil, and it is claimed has had the effect of rejuvenating the trees. Disc ploughs have been discarded; a Fordson tractor was hauling a two-furrow mouldboard plough and getting through about nine acres of orchard per 8-hour day. It is proposed to manure and fertilise the whole of this property extensively this season with farmyard manure, costing 4.50 to 5.00 dollars per ton delivered, at the rate of 15 tons per acre, with an addition of one ton of cotton seed meal per acre or some complete commercial fertiliser at the rate of 15 lbs. per tree. The altitude around here is about 400 feet, while the rainfall is 7 inches to 8 inches per annum. Great difficulty was encountered here in the water supply, boreholes having proved quite unsatisfactory. After spending some 40,000 dollars on boring, with practically no results, an irrigation district was inaugurated which took in this property. This irrigation district supplies water to some 15,000 acres at 12.50 dollars per acre per annum, the water being obtained many miles away and brought down in a canal. The right to this water, however, has been contested in the courts by others for four years and is still in litigation.

A valley orchard of 30 acres, with orange trees, mostly Navels 25 years old, was producing a crop of good fruit, which was then being picked. The soil is a sandy loam, 3 to 4 feet on top of a hard pan, through which it is almost impossible to get any water. A borehole on the property supplies irrigation water about $1\frac{1}{2}$ acre feet, which is considered ample for its requirements. Irrigation is carried out about every three weeks during the dry season, but is not run in the winter unless the season is very dry. The trees look well, and the previous season gave a net return of 26,000 dollars from the packing house, while the year's working expenses, including taxes and depreciation, had been 8,000 dollars, leaving a handsome profit. Very little pruning had been

done, but it was proposed to go through the trees and thin out when the crop was off. Hand hoeing or forking had not been done on account of high cost of labour, and this seems general about here with old trees. The owner was manuring this orchard with 20 tons of farmyard manure per acre, with an additional ton of cotton seed meal, all of which is ploughed under with a mouldboard plough.

An orchard of 20 acres planted eight years ago to one-half Navel and the other Valencias was an exception to the average place of an absentee owner, who visits California once a year. The 20 acres were purchased at 120 dollars per acre as raw land; the irrigation scheme *ex borehole*, including pumping outfit, cost approximately 2,000.00 dollars, and has yielded a steady 10 miner's inches of water (about one-fifth of a cusec.). The situation is on high land, the soil deep, of good red loam. Irrigation water has been applied in monthly periods by furrow system *ex concrete stand pipes*. No cover crops have been used, as it was supposed there was not sufficient water for this and the trees, so about 10 tons per acre of farmyard manure has been given annually, but so far no commercial fertiliser has been used. This has tended to make the oranges rather coarse and a bit late in colouring; this season an addition of commercial fertiliser is to be used. Some pruning had been done, but not much, but it was proposed to go more thoroughly through the trees after the crop had been harvested. The Navels were being picked at the time of my visit, and were running out about 2 to 2½ boxes per tree, and it was estimated the Valencias would average about 3 to 3½ boxes.

The property adjoining this was a striking example of what neglect or bad management can effect. There were some 60 acres of oranges planted about the same time, but here the trees were stunted and unhealthy, producing a very poor crop; I was informed the trouble had been lack of water and nourishment.

An expression of opinion was given by a party who has been identified with the orange business for close on thirty years, both in Southern and Central citrus areas, that the Central citrus belt produces better Navels than the Southern California sections, not only on account of being earlier, but the quality is better. The soil is considerably better in some parts here, and other conditions are more suitable, but it is admitted that there has not been the attention paid to fertilising and general care that there has at the South.

A fairly typical property of 60 acres was purchased three years ago by the present owner for 65,000.00 dollars, including a good house, barns, implements, mules and two boreholes, with pumping outfit, one of which was 500, the other 450 feet deep. At times as much as 40 inches have been pumped from these two boreholes, but 20 inches is the usual amount worked on; six to seven irrigations are given during the year, being applied by the usual furrow system, the water being kept on for three days. So far as the owner knows no deleterious salts have been present in this water. The soil is a fairly stiff clay of several feet, with a sub-soil of a sandy nature. No ploughing is done—only chisel tooth cultivators being used—neither has any sub-soiling been done. Pruning in the way of thinning more for deadwood than anything else is done

regularly. The trees are 13 and 8 years old, about two-thirds being Navels and the balance Valencias. Twenty acres of Navels, 13 years old, produced last season four boxes per tree, while the Valencias of eight years were holding up an immense crop, estimated at six to eight boxes per tree. All the trees had a healthy appearance. Spraying with a lime-sulphur solution is carried out in the spring and fall, an average of eight gallons per tree being used to control thrips, scale and any fungus trouble that may be present. Since the present owner has taken over, farmyard manure has been used at about 10 tons per acre, plus 15 lbs. complete commercial fertiliser per tree. The working costs on this place for a year, including taxes and depreciation on plant, were 15,000 dollars, while the gross returns were 22,000 dollars, leaving a net profit of 7,000 dollars on a capital of 65,000 dollars.

A very interesting property belonging to a syndicate was visited of some 100 acres, all of which was planted with oranges, mostly Navels, with some Valencias. The trees here are 15 to 16 years old; the situation is sheltered by the hills, and the soil is a red loam, but fairly heavy. The soil is 3 to 5 feet deep; below this a natural hard pan is encountered which is from 1 to 4 feet thick. No blasting to break through this hard pan has been done, as it is considered dangerous, and the depth of soil above it is supposed to be sufficient for the good growth and production of oranges if properly attended to.

Irrigation water is obtained from three boreholes around the property, which in the aggregate supply some 50 miner's inches (approximately one cusec.). Water is supplied in the usual furrow system in three to four week periods, each application taking 72 hours, when about a 3 inches watering is given. Irrigation usually stops about the end of September, as it is found that the soil is sufficiently moist to mature the fruit, which is picked late October or early November. It does not commence again until April or May, unless winter rains fall short, when irrigation is resorted to. When the present manager took over this property some three years ago, the orchards had been badly neglected for some years, so much so that the returns had fallen to less than one box per tree. The manager decided some drastic remedy was necessary to build up the trees again, so he thinned out heavily, taking out all water shoots. He then fertilised heavily. He has not yet grown cover crops, but proposes to do so if sufficient water is available. The land is ploughed in the fall, manured and left in the plough until the spring, when cultivation is continued through spring and summer. All trees are sprayed twice annually in the spring and fall for thrips, fungus and scale with lime-sulphur solution mixture. As I remarked above the orchards had been neglected, and the crop returns were less than one box. In the winter of the first year of the new management, 20 tons of farmyard manure were given, plus 3 lbs. per tree of sulphate of ammonia in the following spring. The orchards produced three boxes per tree in the next season, when 15 tons farmyard manure in furrows were given per acre in winter, plus 30 lbs. per tree of a commercial fertiliser in spring. The next season, being the time of my visit, when the crop was practically all picked, the average per tree was eight boxes; twenty tons of farmyard manure were to be applied

per acre last winter, plus 40 lbs. of complete commercial fertiliser per tree. These orange trees were planted 24 feet on the square and are now fine, healthy specimens producing, as I have shown, big crops of fine fruit, which packed last season 85 per cent. fancy grade. The yield is likely to increase still more. Picking was going on at the time of my visit, but most of the trees were stripped. The fine condition of the trees then and the crop returns last season show very clearly how the trees had responded to good treatment in the last two years.

In driving around the Visalia, Exeter, Lindsay and Porterville area (Central citrus belt), a very marked difference was noticeable between orchards in one neighbourhood, often even in as close proximity as one grove adjoining another. On the one would be a thrifty lot of trees bearing good crops of oranges, while right alongside in the same soil there would be trees of the same age, stunted, unhealthy and giving little or no returns. On enquiry the difference could usually be ascribed to indifferent attention.

Various districts were visited in the Southern California citrus belt, which is the largest area for citrus fruit in the State. At Riverside is situated the citrus experiment station, where an orchard was planted some four years ago consisting of Washington Navel and Valencia oranges and Marsh grapefruit. These trees, which were propagated from buds from selected trees, were well grown, healthy, and have a small crop. I noticed an occasional freak specimen on the Navels, although the trees were raised from pedigree buds. Beans have been planted and reaped, paying most of the upkeep, but the haulms were turned in in furrows alongside the trees. It is proposed to commence a comparative fertiliser treatment after the fifth year. A very illuminating object lesson in citrus stocks was seen here, showing the necessity for thorough selection, by discarding all poor specimens, from the seed to the time the young seedling is set out in nursery rows and after. Trees grown from buds brought from Bahia a few years ago are producing fruit of similar type to good Washington Navels.

Dr. H. S. Fawcett, Professor of Plant Pathology, who was kind enough to examine the specimens of orange leaves I had taken from Rhodesia, showing circular spots, gave me the following report:—"I have made a careful examination of the specimens of citrus leaves containing the light, circular spots, in the centre of which there may or may not be a small raised pustule. I have been unable to find anything in these spots to which I could attribute the cause of the trouble. The spots are different from anything which I have ever seen on citrus leaves either in California or Florida. I would judge from the appearance of the trouble that it was of sufficient importance so that a special investigation ought to be made by a plant pathologist.

"It would seem to me that in the investigation of such a trouble it should be worked on while the specimens were still fresh, and especially at the very beginning stages of the spots.

"Regarding your question as to whether the disease might have been brought in, or be influenced by the rough lemon stock which you say is so commonly used for citrus in your country, I would not be able to

give any definite opinion. If the rough lemons which are growing wild along the river commonly have this spot on their leaves, it is, of course, quite possible that it is some disease that was first on the rough lemon and spread to the leaves of the budded orange trees."

Mr. A. D. Shamel, Physiologist of the Federal Department of Agriculture, was very insistent on proper and systematic selecting of buds, as also of stocks, which subject has been recently very clearly set forth and discussed by Sir J. Percy Fitzpatrick in his widely distributed bulletin on citrus growing in California, written after a visit to that country a year ago. Mr. Shamel was very interested in what I had to say regarding the work in South Africa, and quite realised the great difficulties one has to contend with when starting and building up the industry in a new country. Having explained the reasons for rough lemon being adopted as the universal stock for citrus trees in South Africa, he informed me that it was quite usual for young trees on Florida sour stock (which is used in California) to produce rather coarse oranges in their early stages of bearing, but that the quality of the fruit improves as the trees grow older.

The lemon situation in California was very serious; this was mainly brought about by heavy importations into United States markets of Italian lemons. On account of the low rate of exchange Italian shippers are able to sell lemons in United States of America at a figure less than California growers can grow them for; Italian lemons were selling in New York and elsewhere in U.S.A. at 1.50 dollars to 2.00 dollars, which at the existing rate of exchange was worth about five times that value in Italian liras. At this time California growers and shippers had over 1,000 carloads (approximately half a million boxes) of lemons ready for sale in cold storage, which they were unable to dispose of on account of adverse markets due to these exchange rates, and this quantity would fast increase, as the fruit had to be picked or allowed to rot unless market conditions improved. There was a move to manufacture citric acid in larger quantity than has been done, but it is claimed that this article cannot economically be manufactured in California in competition with the Mediterranean littoral, while beverages are a comparatively small item. It was anticipated that when America were "dry" a very large amount of lemons would be used for new soft drinks, but it appears, now that "whisky sour" is no longer allowed to be sold openly, that lemons are not yet required in such large quantities as they were previously.

Owing to the long season during which packing houses operate in Southern California, wages were considerably lower than around Central California districts, where I realised very high wages had to be paid so as to attract labour for their short rush season. Ranch labourers, pickers, etc., white, Japanese or Mexican, were getting 4.00 dollars to 4.50 dollars per day. In the packing houses, truckers' wages were 40 cents to 50 cents an hour, carloaders and head-graders slightly higher, while packers were getting 6 cents a box. Fast packing is not encouraged, and more care generally is taken. An average packer gets through 60 to 80 boxes per day, which is considered quite sufficient in the best run houses. Wrapping is done with a twist for top and bottom

layers, and it is insisted on that for the other layers the wrapper must be clear round the fruit, which must not be merely thrown at the paper and placed in the box; each layer must be firmed down with the hands when completed.

Orange picking gangs are mostly supplied by association packing houses, but whether the pickers are employed by the packing house or grove owners, the packing houses have inspectors continually travelling around amongst their growers, and these inspectors furnish reports as to the condition of fruit and the care taken in picking in each individual case. The Exchange packing houses also employ men who travel around from one association house to another, in their respective districts, in order to inspect the fruit being graded, sized and packed, so that the grades will be kept up to their proper uniform standard. These inspections among the pickers and packing houses are very important features of the orange business, and are, undoubtedly, great contributing factors to the arrival of fruit at distant markets in good general condition with a minimum of waste. Sunkist oranges, fancy and choice, are certified grades and trade marks of the California Fruit Growers' Exchange, and they insist on them being kept up to high grade in every association house, hence the double inspection. Pools are made up, at intervals, in terms of packed boxes in some houses and weight of fruit in others. It seems to be usual to have four or five pools during the season, the first for the Thanksgiving market (end of November), the next for Christmas, then for New Year, and afterwards to the finish of the Navels, with one or two pools for the Valencia season.

Water for irrigation is a very expensive item in Southern California, where the cost in some cases is as much as 35.00 dollars per acre per annum for pumping, general maintenance of canals, etc., in addition to an original 200.00 dollars per acre as part of purchase price of land. It will be seen that this item alone necessitates a large output from the trees in order to pay interest on the money expended, to say nothing of all other essential expenses. It is estimated for the last year that between 250.00 dollars and 300.00 dollars per acre will be the figure for annual maintenance, which is greatly in advance of pre-war costs. There was, however, a distinct tendency for labour to come down, which will automatically bring down costs for the coming year. There was a general feeling among employers that wages had to be brought down, or else they could not carry on, and an organised move in this direction seemed to show that labour was prepared to accept a smaller wage, as the supply was increasing over the demand, and war time conditions no longer existed. This seemed to be fairly general, and is bound to even things up before very long. For the last few years everybody has owned a motor car of some sort, but it looked rather as though the peak had been reached, and prices were going to slide down. I learnt that there was one motor car to every fourteen people (men, women and children) in the State of California, while the position in the State of Iowa was one car to every six people.

I visited a number of citrus nurseries, and was not greatly impressed with the growth or general condition of the young trees as compared with that in this country.

I observed in many parts of Southern California that open irrigation distributories, constructed of cement concrete or granite slabs cemented together, are taken down the steepest grades, on a level with the gradient of the hills, and not stepped at intervals so as to lead out of still water, as is done in some places. The method adopted of diverting water at outlets is to let a slot into the floor of the channel which leads directly to each little opening, and by this means getting a perfectly constant stream of water flowing over the orchard runs; another method used is to set a batten diagonally across the floor of the channel, so that the lower point is opposite the opening; this is also perfectly effective. I am of opinion that the slot in the floor method could be adopted in this country instead of the present stepping system, and should effect considerable saving on cost of construction.

I may say that, from my observations and authentic reports given me, probably half the acreage under citrus in California is still irrigated from open distributories (made of cement or granite blocks laid in cement with miniature sluice gates at each opening), constructed as described above, or when on flat land with an even floor and any temporary measure to increase outflow at outlets if necessary. It is considered that this older method is as effective as by using the underground stand-pipe system, but it is conceded that the latter takes up less room, although it is more costly to construct and might be installed if for any reason a change was carried out. It is considered, however, in some quarters that the underground stand-pipe system of distribution for irrigation water does not give as effective control as open channels with slots in the floor.

Orange orchards in Southern California are of all sizes from 5 to 40 or 60 acres owned by individuals, up to several hundred and even thousand acre company undertakings, of which I visited a number of all sizes.

The same great variation in condition of orchards and trees is noticeable in Southern California as elsewhere. An orchard, or perhaps a group of orchards, may be observed which are obviously in trouble, and these may be right alongside fine healthy orchards, with identically the same soil, water and climatic conditions. On enquiry one usually finds that poor orchards are the property of absentee owners, and the whole work of maintenance is in the hands of a contractor. This appears to be quite a frequent occurrence, where companies in years gone by have developed large properties, and as opportunity occurred sold off blocks of orchards in various stages of growth. The orchards still retained by the developers usually show up well, and the same may be said of blocks sold to individuals who live on and work their own properties, but in a general way it may be said those of the absentee owners do not get the same good care, and are consequently unthrifty, non-paying propositions. The absentee owner has undoubtedly been a large factor in reducing the general average production of oranges per acre in Southern California. Some companies, when they sold land, developed or otherwise, agreed to maintain the orchards for the purchaser if so desired, and handle the crop on a percentage basis, but in recent years this system has been dropped, as the companies found they

could not manage them as well as their own holdings. Under these circumstances absentee owners who had for years adopted this method of operating their orchards, have now to get the work done on contract, which is not conducive to good results.

On a hillside property of some 200 acres of deep red loam planted 18 years to oranges, the gross returns the previous season had been over 800.00 dollars per acre. It was estimated that to get good results an expenditure of 250.00 dollars per acre for maintenance was necessary, and if the net returns were 200.00 dollars per acre it was satisfactory. Water for irrigation is pumped from a canal to most of these orchards at a cost of 5.00 dollars per acre per annum, in addition to the annual canal water rate of 10.00 dollars per acre, allowing one miner's inch (1.50 of a cusec.) to $3\frac{1}{2}$ acres. Irrigations are applied at 30 day periods throughout the dry season, and also during the winter if rainfall is short.

A twenty acre orchard, not far from the above, of seven-year-old oranges, on granite soil about 4 feet deep, was producing three boxes per tree. This place was being fertilised with 8 cubic feet of farmyard manure plus 10 lbs. tankage per tree.

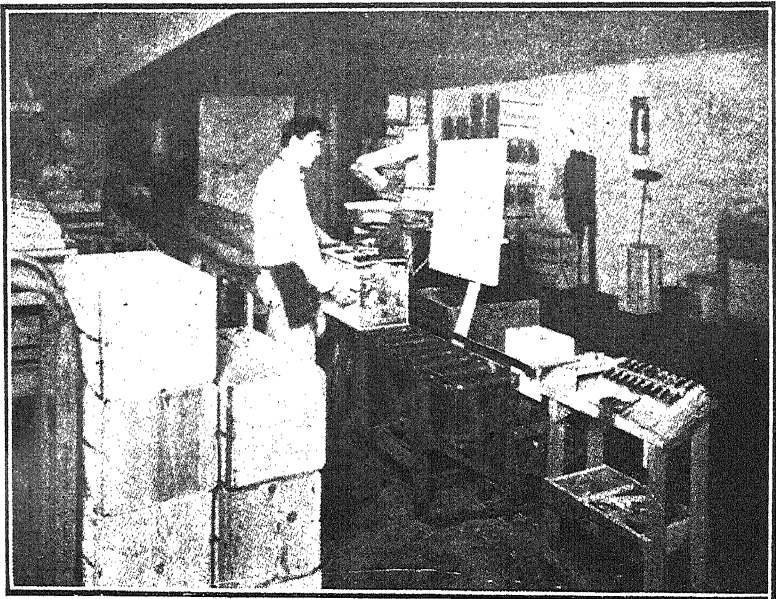
On a red granite soil of 8 to 10 feet depth, with no hard pan, and on fairly steep hillside, 20-year-old Navels were producing an estimated crop of six to seven boxes per tree. The orchard had been well looked after from the commencement. The altitude here was about 1,500 feet, and fruit ripens later than in some sections.

An interesting experiment is being carried out on a large property that I visited. Two years ago a farm was purchased with the right to some old tule (reed) beds which have become a mass of peat. A compost is made of this peat, manure, basic slag and cull oranges or lemons. I saw some of this in process of being made; a layer of peat and manure about one foot is thrown into the pit, then about the same depth of cull oranges or lemons, on which is distributed about half a ton of basic slag. This is proceeded with in the same proportions until the pit is filled; about six months are required for this to decompose and be ready for use. When applied in the orchards 10 cubic feet is allowed per tree, placed in deep furrows in the centres of the rows.

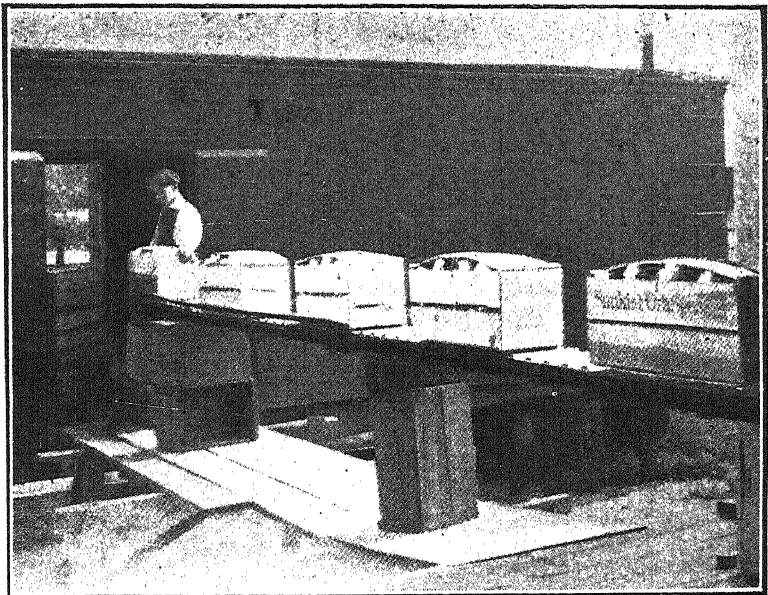
The demand for manure, alfalfa (lucerne) and bean straw for turning into orchard land in California is so great that the price is becoming almost prohibitive, and there appears to be a difficulty in getting a sufficient supply.

Much of the planting of oranges in Southern California has taken place in the last two decades on hillsides in order to get away as much as possible from damaging freezes, which have been of rather too frequent occurrence in some of the older planted valley lands, except in certain counties or districts where the frost hazard has not to be greatly considered. The soil of the valley lands is, speaking generally, deeper and of better quality than on the slopes of the foothills, but the frost hazard is so great in some of the valleys that very large acreages once planted to oranges have gone out of use for this purpose.

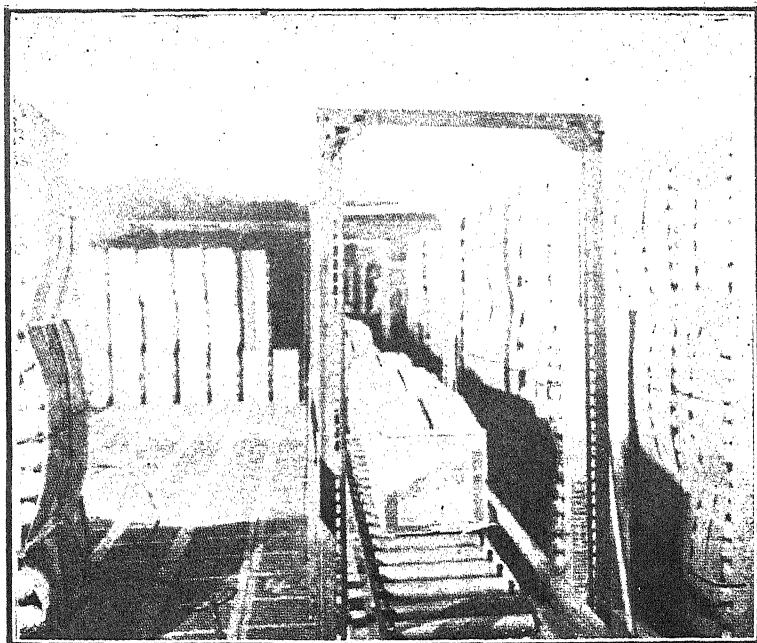
On orange properties where there is any possibility of a freeze occurring a smudging outfit is maintained, and is looked upon as a



The presser and the press.



Loading boxes of oranges into railway car from packing house, California.



Pre-cooling room of packing house, California.



Loading the refrigerator car.

necessary form of insurance to protect the trees and crops from frost danger. On one large property, consisting of some 2,500 acres citrus, a complete smudging outfit has been installed in recent years at a cost of 100,000.00 dollars. The fuel used for smudging is known as crude oil, which is not petroleum as it comes from the wells, but the residue from a refinery, which contains some of the heavy oils: smudge oil used to cost 2 cents, but now sells at 7 cents a gallon. In addition to the installation, the annual cost of smudging for fuel and labour is from 25.00 dollars to 50.00 dollars per acre.

The price of citrus land has varied greatly in various sections. A large holding was bought and developed some thirty years ago by a company, who still retain a portion. Blocks of varying sizes were sold to buyers, some of whom run their own orchards, others being absentee owners, at prices ranging from 500.00 dollars to 2,000.00 dollars per acre, according to the period of sale, age and condition of trees, quality of soil, etc. The soil on this property is mainly from granite and diorite formation, fairly deep in lower levels, but shallower on slopes. Water for irrigation is obtained from a canal by gravitation for most parts, but pumping from canal has to be resorted to in other parts.

I would like to emphasise the fact that in Rhodesia we have the opportunity of getting very much higher net returns from orange growing than is the case in California, by reason of our cheaper land, water, labour and transport, and these points were made much of by many growers and shippers with whom I discussed them. We have large market opportunities which only require proper organisation on sound lines by the right people.

In California the returns from oranges are very large in some favourable instances, but the average is comparatively small on account of the very heavy expenses entailed in both growing and transporting their fruit. It may be interesting to give the experience of a large citrus fruit grower and packer who has been in the business for some 30 years in California. He originally had 1,500 acres planted to oranges, a half of which was sold a few years ago. Over a period of 14 years the net returns, after paying all expenses, including maintenance, picking, packing, shipping, taxes and interest, were 8 per cent. per annum for the capital outlay. He packs and ships his own fruit, and has his own selling agents. Experience shows that an orchard in bearing from 8 to 20 years, taking it over, say, 1,000 acres, should produce six boxes of oranges per tree; of course some trees would do much better, but as an average this is good. It was insisted on that it is essential to keep up a standard pack of consistently good quality rather than a fancy brand that may have more good looks than eating quality; and also that one must keep one's brand on the market at regular intervals right through the season.

I would say that Californians are very optimistic in regard to orange growing, and consider that although it has its ups and downs in the markets and an occasional damaging freeze, on the whole it is a perfectly good investment as compared with other businesses, agricultural, trading or otherwise. The reasons for this opinion are generally stated to be that people generally have got into the way of using oranges as a regular

thing, and there are comparatively limited areas in the world where good commercial oranges can be profitably raised. For these reasons, together with our other advantages already mentioned, Californians expressed the opinion that Rhodesia and South Africa should be able to build up a good business in Europe, but we must send only good fruit in sound condition, which will advertise itself; and further, that we could use advertising propaganda with advantage.

I met a grower of oranges on a large scale in Southern California who had recently returned from a trip to Europe, and while there saw South African Valencia oranges on the English market. These he said were as good, if not better type, than the California Valencia.

It is a freely expressed opinion in California that large companies have succeeded in making good paying concerns of their undertakings where the local management has had complete control, or when a thoroughly competent manager, who knows the fruit business, runs the place under the direct supervision of a resident director, who can give his decision on any point right on the spot. On the other hand, similar undertakings have failed to make a success where the local manager has to refer all matters to his directors perhaps many thousands of miles away, as the directors are not in intimate touch with the requirements; with fruit growing quick action at the required moment is essential, while delay may bring disastrous results. It is admitted that fruit growing is a specialised branch of agriculture, and the local management must have intimate knowledge of the business. My opinion entirely coincides with these expressions, of which the proof appears to be fairly evident in various concerns around the State.

The necessity for co-operation in shipping, distributing and selling citrus fruits, in fact every branch of the industry, both in Rhodesia and South Africa, is greatly urgent.

Unless we can put on the markets a standard commercial article, California and other citrus growing countries will get in ahead of us on the European markets. While the present rate of exchange is against America selling in England, this will not always be so. In the ordinary process of business the California Fruit Growers' Exchange have men all over the world looking for possible new avenues for the disposal of their oranges. It is therefore of vital importance for us to use every endeavour to get our oranges into the European markets in the same good condition, under a thoroughly efficient method of distribution, in which California does now in America, and undoubtedly will do if she starts to send to Europe. So far only comparatively small consignments of oranges have ever been sent over from California to England—approximately 100 carloads in a season, usually about March and April, when Navels are sweet.

The only way we can be certain of our oranges reaching Europe in as good condition as Californian fruit arrives in its distant markets is to raise the right class of fruit, give the trees the best possible attention, and use every precaution known to be of value in the picking, packing, railing and shipping operations. Every item is important in the final result of attaining our object.

Crop Rotation and Mixed Farming.

(Summary of Lecture by the Chief Agriculturist to the Midlands Farmers' Association.)

There are people in Rhodesia who seem prone to think that as a country we are ill supplied with crops, and this is sometimes advanced as a reason why crop rotation cannot be adopted. If, however, the number of our proved summer crops is compared with the range of those grown in other countries, it will be seen that this is not entirely the case, and on the contrary Rhodesia has quite an adequate number of proved crops to provide for a systematic rotation.

All young countries have first to pass through the pioneer stages of farming, which from the agriculturist's point of view means one-crop farming. This has been the case in America, Canada and Australia, but in these great countries as virgin soil fertility has become impoverished, rotation and manuring have had to be adopted. Results already obtained on the Salisbury experiment station, and reported on in Bulletins Nos. 207, 342 and 382, have shown to what extent rotation and manuring increase the maize yield, and these results are confirmed and supported by numerous American experiments planned on very similar lines. Generally speaking the need for rotation is well recognised in Rhodesia, but in spite of this it is but little practised.

All great geographical divisions of the world are primarily suited to the production of one or other of the great staple grain crops, and this particular crop nearly always greatly preponderates over all others in that particular climatic zone. Some farmers in this Territory have been looking to the introduction of fibre crops to provide for a rotation. At best these could only do so to a very limited extent, and it is extremely unlikely that any other crop will ever challenge the supremacy of maize in Rhodesia.

Statements have recently appeared in the Press to the effect that a very small proportion of Rhodesian maize growers are actually growing maize at a profit. If this is so in spite of cheap labour and cheap land, there can surely be but one essential cause for it, namely, inadequate yields per acre. This, affecting as it does so closely the cost of production, is a more important factor than any other, and is a difficulty which can only be overcome by adopting more scientific farming methods.

If we consider what is implied in other countries by the term rotation, it will be seen that rotation does not mean the growing each season of a greater variety of crops which can be *sold off* the farm, but rather the continued growing of the particular grain crop most suited to local conditions, with, however, a reasonable proportion of the land cropped to legumes and fodder and hay crops. In no country is the bulk of these legumes and hay crops generally directly saleable, but on the contrary the whole essence of the rotation is the feeding of these crops into live stock.

We have in Rhodesia several excellent change crops, the growing of which benefits the land for a following maize crop. Amongst these are velvet beans, kaffir beans, sunflower, manna, oats, peas and to some extent ground nuts. Certain of these are not directly saleable, or the market for them is so unreliable as to be negligible. They are all excellent feed crops, however, and several of them can only be utilised to best advantage in this way.

Farmyard manure is essential to successful arable farming. The feeding of these crops into live stock on the farm, together with the plentiful use of litter in the kraals, means more manure and manure of higher quality.

The essence of rotation, look where you will, is the adoption of mixed farming, whereby at least a certain proportion of the live stock kept on each farm are of such a grade as to render their feeding with certain crops grown in the rotation profitable. Until this fact is realised, arable farming in Rhodesia will remain very much of a speculative gamble. It is not, however, necessary for farmers to possess the highest grade of stock before they commence rotation and feeding. Through lack of grading up, the stock fed may not for the time being give the best monetary return for the food put into them. This, however, will increase as the quality of the stock improves. Meanwhile the increased maize yields, the better security of the general farming operations, and the more economical use of labour throughout the year, brought about by the growing of the rotation crops and by their conversion into meat, milk and high quality manure which in turn will be returned to the land, will compensate for any temporary loss on the feeding.

In all parts of the world mixed farming is the basis of agricultural prosperity, and this mixed farming does not mean a decrease in the gross production of the staple grain crop of the country, but on the other hand an increase, by reason of the higher grain yields obtained per acre.

It is sometimes asked how can such a rotation of crops be directly profitable? Surely we must take the long view and appreciate which system will prove the most profitable over a series of years. It is a disquieting fact that with many established farmers pioneer methods of farming were not more rapidly giving place to better methods. As a young country Rhodesia has one advantage at least, and that is she can learn from other countries which within recent years have passed through the same pioneer stages of agriculture. The most important lesson thus learnt is that before permanent agricultural stability can be achieved



Noke Admiral. Bred by Mr. H. R. Evans, Court of Noke, Pembroke; calved 22nd January, 1919. Imported by Mr. Geo. Mitchell, Grange Farm, Bulawayo. Noke Admiral at 1 year 11 months weighed 17 cwt. 3 qrs. 21 lbs.



Weston Peaceful, bred by Mr. Chas. H. Morris, Weston Court, Pembridge;
calved 3rd January, 1919. Imported by Mr. Geo. Mitchell, Grange Farm,
Bulawayo.

one-crop farming must give place to rotation of crops and manuring as a corollary to mixed farming.

Admittedly under certain circumstances it may pay for a period to put the maximum acreage year after year under the staple crop. Is this, however, really profitable? It can mean but one thing in the long run, and that is soil impoverishment. A worn out farm is but a poor legacy to bequeath to one's children, and it is certain that the discriminating buyer will not in future pay the same price for impoverished land as he will do for land the fertility of which has been maintained and built up.

The cure lies, not in awaiting the advent of some other crop which while restoring fertility to the soil will also be directly saleable, but rather in gradually and as rapidly as circumstances permit adopting a system of mixed farming.

The Importance of Dairying.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

The Dairy Cow as a Producer of Human Food.—A dairy cow which gives 3 gallons or 18 bottles per day gives approximately 26½ lbs. of dry matter in a week. Every particle of this is digestible. An ox gaining 15 lbs. weekly puts on flesh in which there is contained only 11½ lbs. dry matter, a fair proportion of which is unsuitable for human food.

The dairy cow as a converter of rough feeds into valuable foodstuffs has no equal. There are to-day in South Africa cows which individually in one lactation are giving us foodstuffs the equivalent of which is only produced by five oxen in four years. Even a moderate dairy cow giving 400 gallons of milk in 300 days would give us approximately 400 lbs. of cheese, which at 1s. 6d. per lb. is valued at £30.

Dairying and the Maintenance of Soil Fertility.—History fails to record an instance where a soil was so fertile that it could indefinitely support a one-crop system such as is too often practised in Rhodesia in the production of maize; but since the majority of our settlers are farming on the sand veld, where the soil is naturally poor, the mainten-

ance and improvement of soil fertility is of the greatest importance. Where crops grown are consumed on the farm, and the manure returned to the soil, the soil is improved both from a chemical and physical standpoint. Dairying should therefore be the backbone of our agriculture on small farms if we are to get the quickest and most lucrative returns. The most prosperous agricultural communities of the world, where intelligent farming reaches its highest levels, depend chiefly on dairying, Denmark and Holland being examples. In Denmark the average yield of wheat per acre, owing to the general use of farmyard manure, is 42 bushels or 12 bags per acre, whilst in Rhodesia the average is 3 bags per acre. On manured land, however, we can and do produce 10 bags per acre.

Another instance of the usefulness of manure in more than trebling the crop obtained is illustrated in the photograph reproduced. The sand veld responds so readily to farmyard manure that a moderate dressing gave Mr. J. Struthers, of Victoria, a return of 12 bags of maize per acre. Unmanured land of similar quality gave only 3 to 3½ bags per acre. It is certainly more economical to manure and cultivate 10 acres well than it is to attempt to obtain an equal crop by cultivating 40 acres even moderately well without manure. It must therefore remain a fundamental principle that for the highest development of agriculture we must combine stock-raising with crop growing, and on our smaller farms no better paying proposition can be found than the co-operation of dairying with agriculture.

Steady Return from Dairy Farming.—Compared with the somewhat uncertain returns derived from crops, the dairy herd yields an income every day of the year. If the farmer is the fortunate possessor of such a herd, he can utilise any crops which may be damaged by either hail, drought or rust, as feed for his dairy stock, and get a return therefrom which will fully repay him for his trouble and labour in establishing the crop.

Suitability of Dairying for Settlers.—One of the principal factors contributing to reliability of income is the steady demand for dairy produce, and since dairying can be conducted profitably on a small scale, it is suited to the settler with limited capital. Beef production, on the other hand, requires considerable investment of capital; the return is uncertain owing to market fluctuations, and is long deferred. A small dairy herd can be handled on every farm, and the cream, irrespective of quantity, can be marketed for cash at the nearest creamery. The marketing of live stock necessitates considerable organisation, and if the best prices are to be obtained the stock must be carefully graded. This entails the possession of a large number of animals. It is in this respect that the small man is at a disadvantage. No elaborate equipment or buildings are required to provide a first-grade dairy product, and if strict attention is paid to cleanliness and temperature, there is no reason why every settler should not produce a first-quality article and obtain the highest price.

Cheapness of Milk Production in Rhodesia.—In most of the older dairying countries of the world the cost of cattle foodstuffs has caused a considerable rise in the cost of milk. Before the War large

quantities of linseed cake, cotton cake, maize, etc., used to be imported into England, Holland and Denmark as feed for dairy stock. The cost of such articles for milk production is now almost prohibitive, and the price of all dairy produce has risen accordingly.

Here in Rhodesia cattle feed can be produced more cheaply than in any part of the world. Every dairy farmer can grow maize, monkey nuts, velvet beans, sunflowers, pumpkins, majordas, sweet potatoes, green forage, barley, etc., etc., all of which form excellent feed in the winter. The great standby should be a silo or silos of sufficient dimensions to be able to supply an ample ration for the dairy stock throughout the period of shortage. The value of silage is hardly appreciated sufficiently in this country. A prominent Danish dairy farmer made the remark that the chief lament of the farmers in Denmark was that they could not grow maize for silage. If they could, they would make money twice as fast as they had done. The significance of this remark can be appreciated when it is realised that Denmark normally exports butter to Great Britain of the annual value of £20,000,000. In Rhodesia, under semi-ranching conditions, cattle can be hired out for twelve shillings per annum. Under these conditions ordinary cows can and do give 100 gallons of milk or more per year. The cost of milk, disregarding interest, risk, labour, insurance, etc., produced in these circumstances works out at about 1½d. per gallon. In England the Government has just issued a White Paper giving the cost of production of milk in 1920. The total net cost at the farm for England and Wales was 37.56d. and Scotland 30.19d. per gallon. As the great bulk of our milk is obtained under semi-ranching conditions, we should be able to make the cheapest dairy produce in the world.

The Demand for Dairy Produce.—"Hoard's Dairyman" last year gave the following interesting figures respecting the butter exportable surplus of the world's great dairying countries in 1913:—

	lbs.
Argentina	8,342,000
Australia	76,334,000
Denmark	200,670,000
Finland	27,867,000
France	42,931,000
Netherlands	81,702,000
New Zealand	41,693,000
Russia	171,030,000
Sweden	46,818,000
Other Countries	22,212,000

Total 719,599,000 lbs.

Of this total, Great Britain imported no less than 463,000,000 lbs., or approximately 64 per cent. of the world's surplus.

In Messrs. Weddel's report for the year ending 30th June, 1920, is contained the following statement:—"Imports of butter into the United Kingdom from all sources during the twelve months ended 30th June, 1920, totalled 80,748 tons, against an average importation of 210,000 tons before the war."

The discrepancy has been made good by the increased use of margarine, as the following figures will show:—

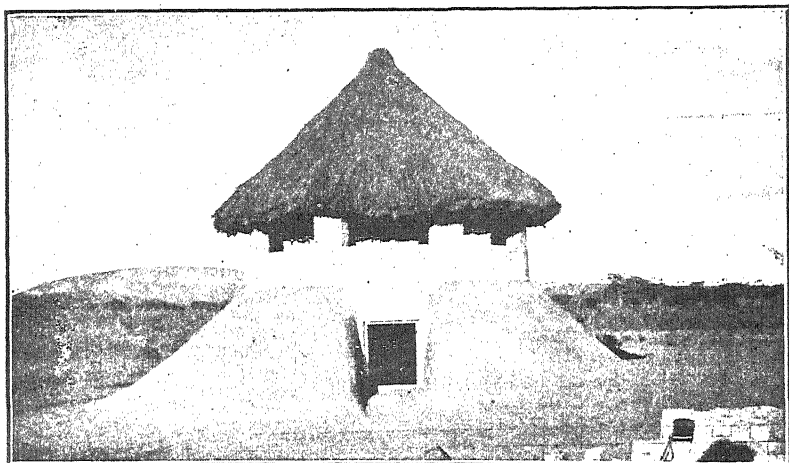
Table Showing Combined Supplies of Butter and Margarine in Great Britain:—

	1914-1915. tons.	1919-1920. tons.
Butter—		
Home supply	50,000	50,000
Imported	190,000	80,000
	240,000	130,000
Margarine—		
Home supply	115,000	320,000
Imported	82,000	40,000
	197,000	360,000

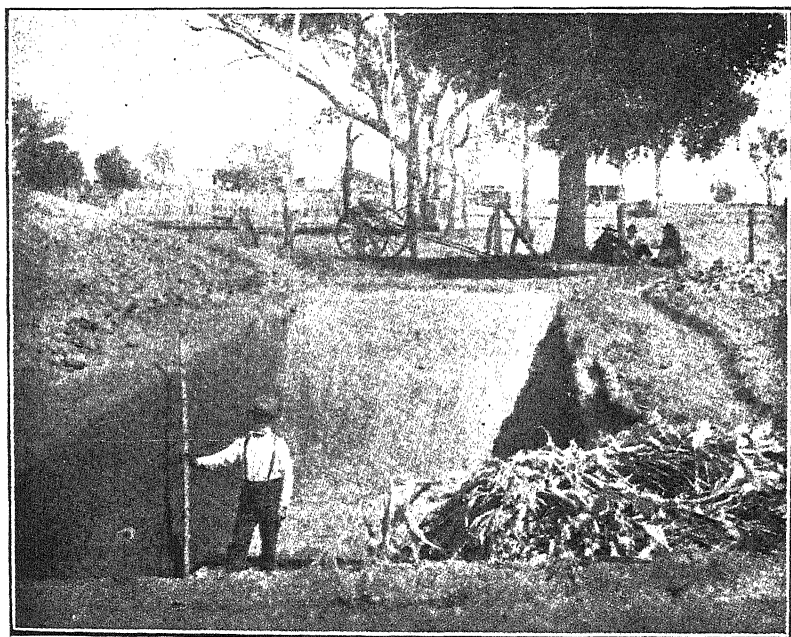
This increasing use of margarine is to be deplored for health reasons, as the cheaper forms of margarine do not contain those mysterious substances called vitamins which are so essential for growth and development of the animal body. People in Britain realise this, and are willing to pay exorbitant sums for butter if they can only obtain it. Butter, however, is still a "controlled" commodity, and overseas purchases are made by a Government department. At the present time Rhodesian butter is being sold to the Imperial Government's agents at Capetown at approximately 2s. 3d. per lb. first grade, and 2s. 2d. second grade, and this trade is likely to continue as long as the contract lasts. To quote further from Messrs. Weddel's report:—"Great Britain's unique position in pre-war days as regards its abundant supplies of good cheap food was gained as a result of the enterprise and foresight of the individual members of the imported food trades, and the time has now come when the business of securing the necessary supplies of food for our people could be handed back to the various traders concerned." What exactly will happen when butter is de-controlled is rather problematical. De-control in the past led to exorbitant prices being asked, and control was re-established. At that time the United States, France and Germany entered into competition with British buyers, and the price rose accordingly. Since this time economic causes have caused a fall in the price of most commodities, and when butter is de-controlled in England at the end of March of the present year, we may find the price falling slightly; but the demand is firm, and it is unlikely that butter will fall below 200s. per cwt. for a considerable time. This price f.o.b. Capetown will enable us to compete in the world's markets, for, as has been already pointed out, we can produce milk more cheaply than most of our competitors. Although Rhodesia, unlike the Union, cannot yet claim to be an exporter of cheese, yet the position with regard to this product is instructive to those who are interested in cheese manufacture. "The consumptive demand for cheese during the whole year was excellent. From all quarters there were reports of a phenomenal counter trade, pointing to an increase in the popularity for this wholesome article of food." Should Rhodesian



Maize fertilised with kraal manure on pure sand, Mr. J. Struthers's farm,
Victoria district; yield, 12 bags per acre.



Silo on B.S.A. Co.'s Estate, Marandellas.



A cheaply constructed, but effective silage pit.

cheese makers wish to develop a cheese export they should note that the English trade demands (1) large cheeses varying from 60 to 90 lbs. in weight, (2) the colour should either be brick red or white. A straw colour such as is popular in South Africa is not required, and cheeses smaller in size than that indicated, and those which are not coloured according to the trade demands, will not obtain the highest price.

Dairying helps to solve the Transport Problem.—It has been already stated that as a consumer of bulky rough feeds, and a converter of these into valuable human foodstuffs, the dairy cow has no equal. A bag of maize fed as crushed maize or meal to a dairy cow of average production, together, of course, with inexpensive bulky foods such as veld or teff hay or grass, may be converted through the agency of the cow into as many as 20 lbs. of commercial butter, valued (at present export prices) at £2 5s., giving a return of at least four times the original value of the maize. At the same time the bulk of material requiring transport is reduced by nine-tenths. A more striking comparison as regards transport can be made between substances of equal value, viz., 4 lbs. of commercial butter and a bag of maize. For export purposes 4 lbs. of butter (in bulk), value 9s., can be sent from Gwelo to Capetown for 5d., whereas the transport on a bag of maize (in bulk) of equal value costs 4s. 6d. If more of our locally-grown maize was consumed on the farm, either by the dairy cow or the pig, the country would benefit materially, the transport problem would be partially solved, soil fertility would be improved and maintained, and the price of land would rise.

Outlets for Dairy Products.—Rhodesia is becoming more and more efficiently equipped with creameries and cheese factories, where milk produced on the farm can be converted into valuable dairy products. Besides the Gwelo Creamery, which has been taken over by the Farmers' Co-operative Industries, Ltd., other creameries have been erected in Bulawayo. We have there the Rhodesia Creameries, Ltd., and the dépôt of the Co-operative Industries, Ltd. Each of these manufacture butter on a large scale, and are equipped with efficient cold storages where butter made in the factories can be stored pending sale or shipment. In Salisbury the creamery which is being built in conjunction with the Salisbury Cold Storage is rapidly approaching completion, and should be in full working order in a few weeks' time. It is probable that the Farmers' Co-op. will also erect a cream dépôt in Salisbury, which will be fitted with equipment for churning and storing butter. These facilities for the disposal of cream are ample for the present; but there is no reason why dépôts or small creameries should not be erected in outlying districts such as Sinoia, Marandellas and Umtali, but before such projects can be considered it will be necessary for farmers to produce much more cream. This can only be done (a) by careful and common-sense treatment of dairy stock; (b) the ample provision of winter feed; (c) by selecting heifers from the best cows for the nucleus of a dairy herd; (d) by the purchase of the best possible bull of a dairy type; and lastly by rational and careful treatment of our young stock.

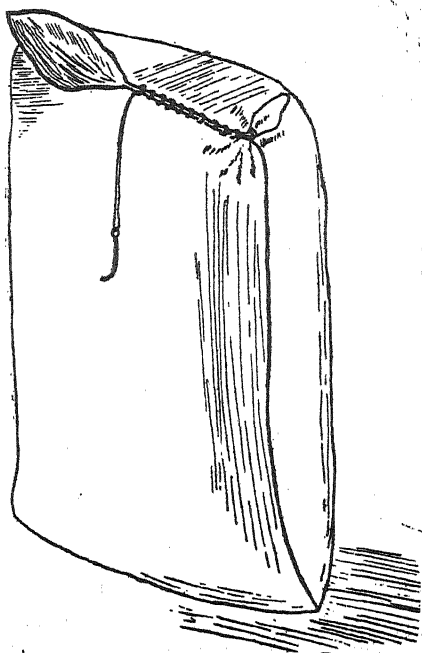
Maize for Export.

WITH NOTES ON GRADES AND GRADING.

By C. MAINWARING, Agriculturist.

While maize is grown in nearly all parts of Southern Rhodesia for use on the farm or to supply our local trade, the surplus portion of the crop is exported and must be transported long distances by rail to the coast and from there shipped to the oversea markets. During the 1920 season complaints were received from buyers and shippers at the unsatisfactory condition of our maize on its arrival at the Port of Beira. The complaint referred chiefly to the inferior quality of bag used, and in other cases to the improper methods of sewing. It is quite often asked by the maize grower why the 2½ lb. bag is insisted upon for export. This question is best answered by a visit of inspection to the wharves, when the inferior quality of bag in handling from the lighter to the ship will be appreciated. It is most important that the bags used for export be strong and durable, otherwise the profitable marketing of the crop is handicapped, since our maize for export has to be repeatedly handled before it reaches its final destination. Intimately bound up with the whole matter of producing the crop is the demand of the market. It is not sufficient for us to grow good maize, but it is equally necessary to send this product to market in a condition acceptable to the buyer. In these days of keen competition, oversea buyers are able to pick and choose to an extent not yet realised by many farmers.

The harvesting of our maize crop usually commences about the middle of May, according to the season or the date of planting. The first consignments are ready for grading and export by the end of June; the bulk of the crop is threshed and ready for export by the middle of September. The harvesting of the maize from the field is done exclusively by hand, and for this purpose extra native labour is generally employed. Before the picking of the cobs is started it is best to thoroughly instruct the reapers to leave all mouldy or rotten cobs on the stalks or on the land, and these if not diseased can be picked up later and used as pig food. The inclusion of a few partly rotten or mouldy cobs, distributed in the bags of threshed grain, is quite sufficient to lower a consignment in grade. The cobs are usually gathered into bags and later loaded on wagons for hauling to a convenient part of the field for threshing. A system of harvesting practised by some of our leading growers, and one to be recommended, is to cut and stook the maize. This method enables the farmer to plough for the coming season while the soil is still moist; it



Illustrating method of stitching sack for export.

also gives the native labourer ample opportunity when husking the cobs from the stooks to sort all mouldy or defective cobs out before they reach the power sheller. Threshing machines of various types are used, some operated by hand and others by power. The object of these machines is to thresh, grade and to eliminate chaff and foreign matter, but it is feared that too many farmers leave the machine to grade for quality also. Threshing by contract is not always satisfactory, because the contractor endeavours to complete as many bags as possible each day; much less grain would be disqualified for export if proper methods and more care were employed in the use of the power sheller. These machines if properly managed are satisfactory, rapid and more economical than the old method of hand shelling, but the farmer must do his part by having all defective cobs picked out before they reach the machine. The grain as it comes out of the machine is bagged, weighed and sewn up. If the grain is intended for export, only new bags of $2\frac{1}{2}$ lbs. should be used. A suggestion has been made that the marking of all bags should indicate the original ownership, thus enabling the actual parcel to be identifiable with the certificate issued. This matter has been referred for the consideration of the Maize Growers' Association. Should this suggestion be accepted by our maize growers, marked bags should not be loaned or sold to neighbouring farmers or storekeepers who may not be as careful in the grading of their grain for export. In addition to the foregoing, it is also advised that "Rhodesia" should be marked on each bag of grain for export, in order to denote the country of origin and serve the purpose of publicity. Although desirable, this can only be enforced, however, if projected legislation regarding grading of produce for export becomes law.

Old, patched, or even new bags which have been used in reaping and are at all worn, are liable to be rejected. The bags of grain are usually weighed as they leave the sheller, and complaints are sometimes heard on the insufficient allowance made to the buyers for protection against actual and natural shrinkage; on the other hand, it is claimed that in some instances an unfair advantage has been taken of growers, or that unreasonable claims are made by the dealers. The natural shrinkage of grain from a well grown and thoroughly dry crop should be very small indeed. Efforts should be made by growers to avoid unnecessary shrinkage by making quite sure that the grain is quite dry before bagging, and every precaution should be taken to secure accurate scale weights. The proper sewing of the mouth of the bag for export is very important; the bag must be sewn with 5-ply double twine of good quality, and the stitches should not be more than one-and-a-half inches apart. Every bag must be provided with two lugs at the corners of the mouth. The grain will not be passed for export if these requirements are not complied with. These stipulations may no doubt seem severe to some growers, but they are most emphatically in the interests of exporters, for the losses in transit are borne by the shippers and not by the consignees.

Bagged grain for export must be stacked in tiers six bags high and two bags deep, allowing 3 feet 6 inches between the double rows of tiers. If the bags are packed closer insufficient working space is allowed the grader, which makes the testing and marking of the bags difficult. The light is also bad for the inspection of the grain if the rows of bags are

too long and narrow. If the maize is to be carted to the station or siding, it is a wise precaution to lay corrugated iron or some suitable material on the ground to prevent dampness and white ants from damaging the sacks, while awaiting railway transport.

Grades.—The standard classes for grading adopted in the Union of South Africa, Portuguese East Africa and Southern Rhodesia, so far as flat white maize (our only export type) is concerned, are as follows:—

R.F.W.1.—Rhodesia Flat White 1. To be sound, dry, plump and well cleaned, with a maximum of altogether 1 per cent. of yellow, discoloured or defective grain.

R.F.W.2.—Rhodesia Flat White 2. To be sound, dry, plump and reasonably cleaned, not containing more than 3 per cent. of yellow, or 5 per cent. of defective grain.

R.F.W.3.—Rhodesia Flat White 3. To be sound, dry and reasonably cleaned, and not containing more than 8 per cent. of defective grain, and 5 per cent. of coloured grain. Grain may be of irregular size and shape.

The letters "R.F.W." stand for Rhodesia Flat White, the trade description used to denote this class of maize, which includes Hickory King and Salisbury White types.

The points for consideration in grading maize for export are explained below:—

Condition of Grain refers to soundness, plumpness, sweetness, cleanness and brightness.

Soundness.—Sound grain, free from decay or the ravages of insects (weevils, white ants, etc.).

Sweetness.—Sweet grain is free from mustiness or objectionable smell. There is no excuse for musty maize in Rhodesia, as we are able to harvest and thresh under the best of conditions. Musty maize may in no circumstances be exported.

Plumpness.—Plump grain should not contain more than 12 per cent. of moisture, to enable it to travel safely from the Port of Beira to Europe.

Cleanness.—This refers to freedom from bits of cob, chaff and all extraneous matter.

Brightness.—A first grade parcel of maize should be bright and showy. Grain which has been harvested too early and then dried out loses its brightness, and a dull sample is the result.

Soundness, plumpness and sweetness are considered the primary points in studying condition of grain for export. Dryness comes fourth, for a sweet sample not quite dry may be dried out, but a dry sample that is musty will never become sweet again.

Grade for Maize Meal.—The class for grading in Southern Rhodesia is as follows:—

- (1) Fineness (18 inch mesh) and condition.
- (2) Bags to be sufficiently strong, but not necessarily new, and the stitching and twine to be as required in maize standards.
- (3) The letters R.M.M. grade marks are stamped on each bag by the Government grader.

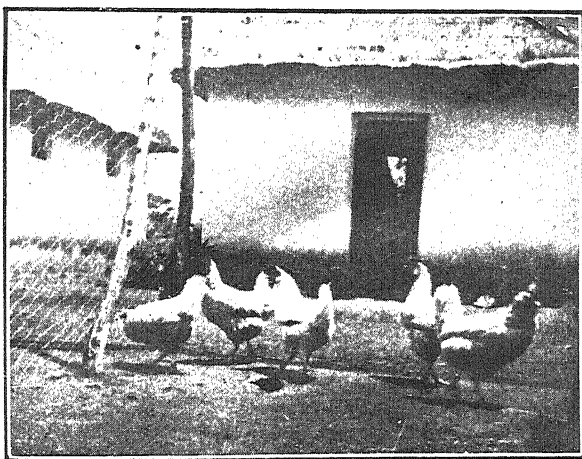
A special inspection is made at Beira by an official of that territory with a view to preventing as far as possible the export of weevilled grain and meal from that port, and the slightest trace of injury by weevil is sufficient to cause grain to be classified as weevilled. Weevil is happily of rare occurrence in Rhodesian maize prior to the end of November, before which date export ought normally to have concluded.

First Rhodesian Egg-Laying Test.

FINAL RESULTS.

By A. LITTLE, Poultry Expert.

This test has been running for 45 weeks. There were 20 pens with five birds in each. The positions are allotted according to the total weight of eggs 2 oz. and over, and considering it is the first test ever held in Rhodesia, the result in production is most gratifying, both from an educational and demonstrative point of view. The test has amply justified its existence, and warranted the holding of similar competitions in the future. The test has gone far to assist in the expansion of poultry husbandry, and has afforded an excellent demonstration of the methods most suitable for the running of poultry in Rhodesia, viz., housing, feeding and general treatment. It is proved that fowls of only ordinary laying qualities, provided they are treated properly, pay, and pay well. Some people seem to have been under the impression that the birds have been forced, and given special treatment; this has not been the case. The feeding and general treatment have been given in a former issue of the *Agricultural Journal* and several times in the



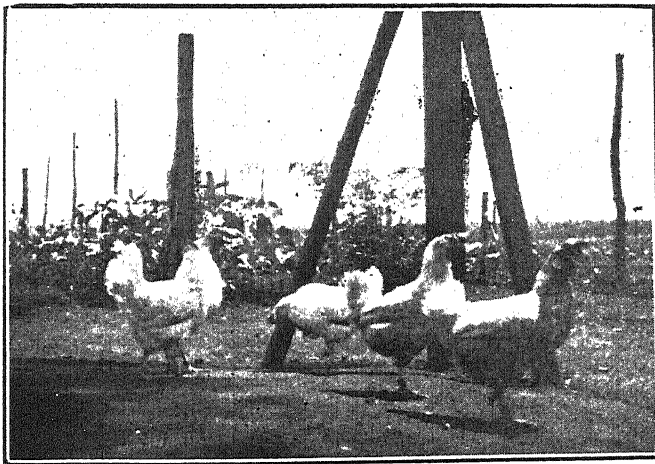
Pen 13, 1st prize. Owner Mr. C. L. Brown, Salisbury.



The best bird in the test. Owner Mr. C. L. Brown, Salisbury.
255 eggs in 45 weeks.



Pen 10, 2nd prize. Owner Mrs. Gibbings, Avondale.



Pen 1, 3rd prize. Owner Mr. H. Tatham, Penhalonga.

public Press. The food used was grown in the country, and the methods can be adopted by *any* farmer or poultry keeper. Regularity of feeding, cleanliness and carefulness naturally have been studied, as they should be by every poultry keeper if he or she wishes to make their birds pay.

The total number of eggs laid during the 45 weeks by the 100 birds (the last few weeks there were only 97 competing, as three died during this period and were not replaced) was 18,067, an average per bird of 180.67 eggs, or calculating for the year, approximately an average per bird of 208.75. There were good birds, medium and a few bad ones; therefore this average all through is excellent. Three pens put up averages respectively of 224, 217 and 195 per bird for the 45 weeks, or, working on the basis of a year, approximately 258, 250 and 225; this, at 2s. 6d. per dozen, gives £2 13s., £2 10s. and £2 6s. 3d. per bird.

Fowls can be cared for and fed on farms at much less cost than when kept in pens; 10s. per bird is ample under the latter conditions. It will therefore be seen what profit can be made from poultry if properly and carefully looked after from market eggs alone, leaving out of account the selling of breeding stock and hatching eggs. The results have been calculated on the total weight of 2 oz. and over eggs to encourage the production of such eggs and the elimination of small eggs, too many of which are produced in the country.

The first three positions are as follows:—

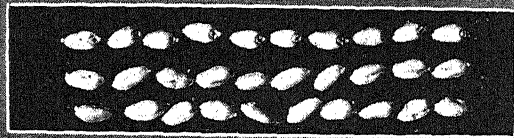
1st—Pen 13, White Leghorns, 142 lbs. 10 ozs.

2nd—Pen 10, White Leghorns, 131 lbs. 14 9-16 ozs.

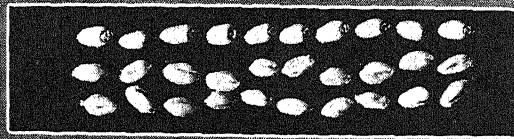
3rd—Pen 1, White Leghorns, 126 lbs. 11 12-16 ozs.

Among other awards, pen 13 receives the first prize gold medal presented by the S.A. Poultry Association and £5 by the National Utility Poultry Society of S.A. Pen 10 receives a silver medal presented by the S.A. Poultry Association and £3. Pen 1 gets a bronze medal and £2. Further records of individual birds and other particulars will be published in a subsequent issue of this *Journal*.

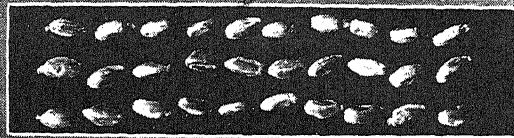
The second laying test commences on 1st April, and will continue for 48 weeks. White Wyandottes, Rhode Island Reds, Barred Plymouth Rocks, White Leghorns, Black Leghorns and Anconas will be represented.



EARLY
GLUYAS.



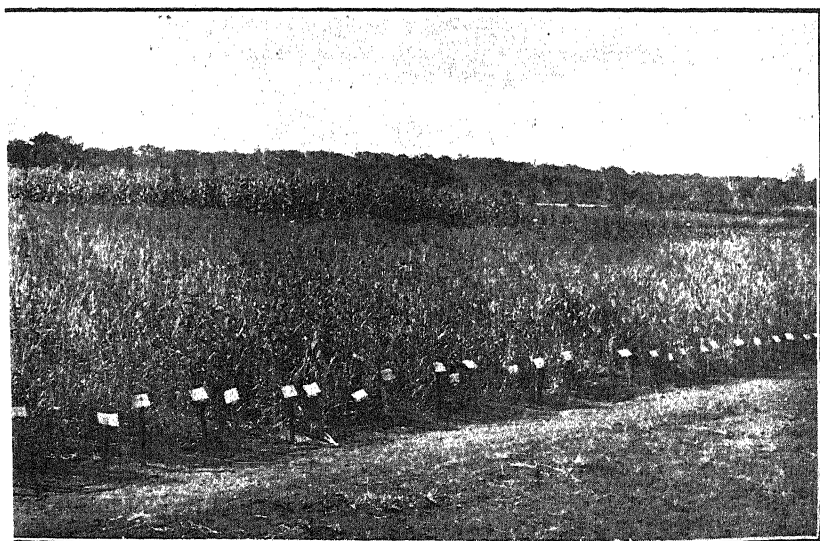
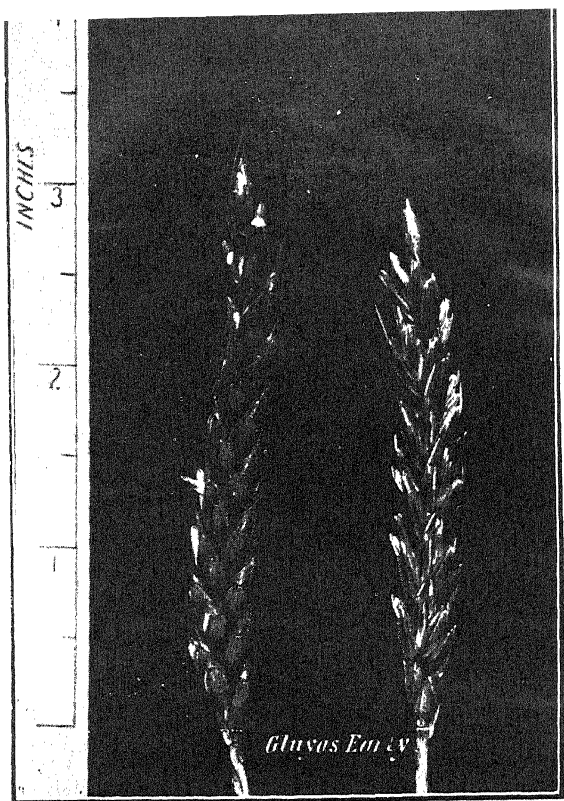
FLORENCE.



BLACK
PERSIAN.



YELLOW
CROSS.



Wheat Varieties, Agricultural Experiment Station, Salisbury, 1919-1920.

Winter Wheat.

RESULTS OF CO-OPERATIVE EXPERIMENTS, 1920.

By J. A. T. WALTERS, B.A., Agriculturist.

The possibilities of the wheat crop in Rhodesia and the desirability of increasing its production have been pointed out in an article on the subject which appeared in the issue of the *Rhodesia Agricultural Journal* for December, 1920. It is there stated that the most satisfactory variety for general use is that known as Early Gluyas, and that this is the one most widely grown. Being also a variety well liked by millers, which is a very important feature where our markets are almost entirely local, farmers are well advised to give it a thorough trial before proceeding to lesser known varieties. But it should not be forgotten that millers require more than one kind of wheat to produce a good blend of flour, and if Early Gluyas alone were grown in Rhodesia it would be necessary to import other varieties in order to obtain a flour locally which could compete with that offered from overseas. Wheats differ greatly in flour percentage, gluten content and strength, considerations which are of vital importance from the milling point of view. Hence it is extremely desirable that production should not be confined to one variety alone. Moreover, it is known that Early Gluyas does not give the best returns in every locality. In Inyanga, for instance, where wheat is grown almost exclusively under irrigation, it is found that heavier yields of grain are obtained from a variety called Zwartbaard. This is one of the durum or hard varieties of wheat so much desired by millers for blending. With the object of ascertaining the most suitable wheats for different localities the Department of Agriculture has for many years distributed different varieties for experimental purposes to farmers throughout the Territory. These have always included different classes of wheat, and the seed has been obtained from such different sources as the Union of South Africa, India and Australia. During the last winter season four varieties were issued for experimental purposes, and below is appended a summary of the reports obtained, with a description of each.

Early Gluyas, a variety well known in Rhodesia, originally imported from the Union, producing a fine, plump, white, medium-hard grain, weighing up to 62 lbs. per bushel. As its name implies, it is an early variety. The reports received indicate that this variety took on an average five months to ripen grain, and the average yield of all the experiments (excluding cases where the crop was destroyed by birds or accidental circumstances) was 962 lbs. per acre. The best yield recorded

was 1,250 lbs. per acre from the Victoria district, off land that had been manured and was irrigated every fortnight. The best yield from unirrigated land (wet vleis) was 1,140 lbs. per acre.

Florence Wheat.—An Australian variety, reputed in its country of origin to be *very early*, and growing to a medium height with the ears tip-bearded like the Gluyas. The grain is good, rather horny, and of average size. The ripe straw is white and rather tender. The bushel weight is given as 65.9 lbs., and the percentage of flour produced is 71 per cent. The reports from growers in this country show that this variety ripened in one case in four months, but more frequently took five months or even longer. The yields on the whole are higher than those of Early Gluyas, the highest being one of 1,590 lbs. per acre. This was under irrigation, and the ground had been slightly manured. The average yield from all returns is 965 lbs. per acre. This variety seems to have been susceptible to the attack of birds in some instances.

Black Persian.—One of the best of the *durum* wheats, which are marked by sturdy growth, broad leaves and heavily bearded ears. The grain is long and pointed at each end, and when cut through appears horny and semi-transparent. The *durum* types are hardy against drought and against rust, and are much in request for blending with soft wheats. The experimental returns for this variety show that it did well on the whole, the average of the returns working out at 973 lbs. of grain per acre, the best yield being 1,400 lbs. per acre on land that was manured and was irrigated three times. Black Persian is a distinctly later wheat than the others, taking from five to six-and-a-half months to come to maturity. The reports indicate that this variety was particularly free from attacks by birds, probably on account of its long stiff beards.

Yellow Cross.—This wheat had attained some prominence in past years as a summer crop in this country by reason of its earliness. In the course of time, however, this resistance seems to have been largely lost, although the acreage down to summer wheats, viz., 685 acres for last season, was largely planted with this variety. A small quantity was distributed for trial as a winter variety, but strange to say it suffered more markedly from rust than the other varieties.

On the whole the results obtained from land under irrigation are distinctly higher than those from wet vlei land. The average yields from thirteen trials under irrigation show returns of 1,100 lbs. of grain per acre. Whereas on the wet vleis the average yield does not exceed 500 lbs. of grain. It is only fair to point out, however, that we are only beginning to exploit our wet vleis, and the yield recorded below by Mr. Mells indicates that with the growth of experience the possibilities from this source are greater than the above figures would seem to indicate.

The following reports have been supplied independently, and as recording the possibilities of wheat growing in one case with irrigation and in the other without are of great interest:—

Mr. Claude F. Radcliffe, Histonshurst Estate, Victoria.—"The soil on which the crop was grown is an ordinary sandy granite loam, which,

when we arrived here four years ago, was much impoverished and from which our first yield of wheat was less than one bag per acre. No summer crops have been grown on the land, weeds only being turned under. A portion of the land received a light dressing of kraal manure in 1918, and in 1919 an artificial fertiliser was broadcasted over four acres at the rate of 400 lbs. per acre, but did not appear to benefit the crop in any way.

"In May, 1920, ten acres of this land, which during the previous six months had been dressed with farmyard manure at the rate of about ten to twelve tons per acre, were sown broadcast to wheat at the rate of 50 lbs. per acre.

"The seed was sown two days after a light shower and was disced and cross-disced in. The land was irrigated for the first time nine days after sowing, and in all received five irrigations.

"Harvesting was completed by the second week in October, and the result was 101 bags (203 lbs.) of clean seed and 2 bags of sweepings, in all 103 bags of wheat from ten and two-thirds acres."

Mr. Radcliffe's wheat yield as reported above has only in one instance to our knowledge been equalled in Rhodesia.

Mr. W. Mells, Marshlands, Norton.—"The land consisted of 35 acres of sand vleis, not typical, however, of the ordinary sand vleis of Rhodesia, being richer in humus. Previous to breaking up it was largely a reed vlei. The variety sown was Early Gluyas. No manure was applied nor was the land irrigated, it being sufficiently damp to carry the crop through the dry season. Sowing was completed on the 19th June, 1920. The grain was ripe and harvesting finished by the beginning of November, the crop having occupied the ground from four-and-a-half to five months. The yield was 300 bags of grain, or an average of about $8\frac{1}{2}$ bags per acre."

Wheat.

ERRATA.

Vol. XVII., No. 6, December, 1920—Page 509, line 39, for 22 read 10; page 509, line 50, for 50 read 40.

Is Weather Forecasting Possible in Southern Rhodesia ?

By C. L. ROBERTSON, B.Sc., A.M.I.C.E., Hydrographic Engineer.

Meteorology is very apt to be commonly regarded as merely the collection of data regarding the weather which is only of scientific or academic interest. An exception, however, is usually made in the case of the measurement of rainfall, as everyone is naturally interested in the amount of rain recorded in the neighbourhood, and how the present rainy season compares with previous ones. In a new and comparatively undeveloped country this view is perforce the correct one, as a solid groundwork of facts has to be constructed before any deductions can be drawn therefrom. It will be my object in this short article to show what practical use is made of meteorological information in the older-established countries and the practical benefits that may be expected to be derived from similar observations in this country, where our records extend over a comparatively short period.

The ultimate aim of meteorology is an attempt to forecast the weather day by day for the locality concerned. In the Northern Hemisphere most European countries, the United States, India and Japan issue weather forecasts. In the Southern Hemisphere, owing to the large tracts of ocean from which no information as a rule is obtainable, it is a matter of more difficulty. But nevertheless in the Argentine Republic, Union of South Africa, Australia and New Zealand, it is found possible to issue reliable weather forecasts. During the war an efficient meteorological service was maintained on the western front, and was found to be of extreme value in providing information for aviation purposes, timing of offensives, gas-attacks, etc.

That these forecasts are of practical value is undoubted whenever the magnitude of the interests involved is sufficiently large to justify the expenditure on the maintenance of an efficient meteorological service. In this connection the words of Father E. Goetz in his presidential address to the South African Association for Advancement of Science at Bulawayo in 1911 are worth quoting:—"It is to be hoped that in this matter the Union Government will break away from the traditions of the former Governments, who seemed to have looked upon the study of South African weather as useless, or at most as a scientific hobby which had to be encouraged a little, apparently because the Governments of the old world, for some unknown reason, chose to do so. Our cousins across the North Atlantic have the reputation, merited or not, of judging

everything by its money-making value. The American Government maintains the most perfect meteorological organisation in existence. In salaries alone the expenditure exceeds £300,000 a year. The number of addresses to which daily forecasts were sent through the offices which the Washington Bureau controls was over 2,000,000, and that quite independently of the people who were reached by the newspapers, which most of them publish the daily forecasts of the weather bureau. If all this daily interest is taken in the work of the U.S. Weather Bureau merely to encourage a hobby of a dozen scientists in Washington, we must admit that the average American is a strange being."

A short summary of the basis of forecasting may be of some interest. It was only during the second half of last century that the art of forecasting the weather was put on a scientific basis. The intimate connection existing between the distribution of barometric pressure over large areas and the weather in general was established as an undoubted fact. The areas of low pressure were also found to have a general movement from west to east over Europe. In addition wind direction and force were found to bear a close relation to the system of pressure prevailing at the time. These discoveries were first utilised for the prediction of storms, and from about 1860 onwards storm warnings were sent to many ports in Europe.

Broadly speaking the weather may be said to depend on the relative positions of high and low pressure areas, and the changes in the weather depend on the movements of these areas. A large amount of patient study and investigation was necessary after these facts were recognised to find out the usual tracks followed by these centres of low pressure and the factors influencing their direction and rate of progress. The different pressure systems had then to be separated into types, and the weather prevailing for each type carefully studied. This has been done in great detail for countries in the North Temperate Zone. The central offices of the countries concerned receive simultaneous observations of barometric height, wind force and direction, and prevailing weather from a number of stations covering as large an area as possible in adjacent countries. These observations are recorded on a map, and a weather chart constructed showing all the factors operating at the time. A study of this chart by an experienced forecaster will enable him to issue a detailed weather prediction 24 hours in advance and a general weather forecast a week in advance for the country concerned. It is to be noted, however, that this type of forecasting is only applicable to countries in the temperate zones where the fluctuations between high pressure and low pressure are marked and appreciable and are the ruling factors affecting the weather. A glance at an ordinary aneroid barometer will explain what is meant. On an aneroid dial the section marked "fair" is over 30 inches, "rain" is 29 inches and under, "stormy" is 28 inches and under, or a fluctuation of 2 inches in barometric height from "fair" to "stormy" weather normally. In the tropical and equatorial zones the barometric pressure is much more equable, and is almost stagnant at the same hour day by day. In this country the barometer is uniformly high during the winter months and comparatively low during the summer months. But the maximum fluctuation in any one year from extreme high to extreme low does not exceed one-third of an inch.

The following facts regarding rainfall and barometric pressure in this country are known:—(1) Rain may occur with both a high and a low barometer, the ruling condition for rain, however, being that there should be a correspondingly higher barometric pressure off the east coast, *i.e.*, that there should be a down grade in the barometric gradient from the sea to the land. (2) The early rains, usually accompanied by thunderstorms, which occur during October to middle December are associated with extremely local areas of low pressure, which would appear to traverse this country from west to east. It is evident, therefore, that any attempt at forecasting the early rains will be impossible until some time in the remote future, when barometric stations are more numerous in this country and in the barren area to the west of us. (3) The general rains from middle December to end of March are monsoon in character, particularly in Mashonaland. There are strong grounds for the belief that the ruling factors influencing them are two belts of high pressure about 34° S. latitude. The one belt is in the South Atlantic and the other in the South Indian Ocean. These belts are supposed to have a movement north and south with the sun, and also an oscillation east and west, and converge over the land in the neighbourhood of the Transvaal during winter. Owing to these belts both being over the ocean for the bulk of the time, any accurate study of them and definition of their boundaries is not very feasible.

It is evident, therefore, that an investigation on a method of forecasting in this country would have to follow a different line from that followed for countries in the temperate zone. The method followed in India will probably afford us a guide. The seasonal monsoon rains in that country are predicted with great accuracy, and also the probable date of their arrival at the different centres. In order to achieve that result, as they cannot accurately study the ultimate cause—pressure conditions over the Indian Ocean—they study its effect on weather conditions in surrounding countries. They find that the following factors affect the amount of the monsoon rain:—

- (1) Mauritius pressure in May.
- (2) South American pressure in April and May.
- (3) Rainfall—Zanzibar and Seychelles in May.
- (4) Snowfall in Himalayas in May.
- (5) Indian pressure in previous year.
- (6) Monsoon rainfall in previous year.

It is probable that an investigation on similar lines would lead to equally good results in this country and render possible fairly reliable forecasts of the amount of the general summer rains. An estimate as to the probable date of their arrival would be a more difficult problem. A detailed study of the rainfall data from certain islands in the Indian Ocean might furnish a clue, but as nothing has been done in this direction yet, it is impossible to say whether it is feasible or not. Father Goetz, of Bulawayo Observatory, compared the rainfall records of Mauritius and South-West Africa some years ago, and found that abnormal wet and dry years showed three or four years later in South-West Africa than they did in Mauritius. He was of the opinion that there was a cause gradually operating from east to west across the con-

continent causing a retardation in the beginning of the wet and dry periods. A comparison of rainfall figures for Mauritius and Salisbury is interesting and is given below. In this table the percentage deviation of the rainfall at Mauritius for each season from the mean rainfall is compared with Salisbury rainfall's deviation from mean three seasons later.

Mauritius (starting 1887).	+39	-10	+3	+26	+18	+11	+3	-3	+17
Salisbury (starting 1890).	+52	-24	No record.			+9	-9	-14	+20
Mauritius (starting 1896).	+32	-5	-42	-13	-15	+2	-5	+12	-31
Salisbury (starting 1899).	+16	+30	+14	-36	-5	-6	-13	+19	-12
Mauritius (starting 1905).	-8	-5	-27	+22	+7	-2	-8		
Salisbury (starting 1908).	+19	-2	+5	-31	+2	-12	+7		

It will be noticed how close is the agreement, particularly at the start of the series. In only seven cases is there any discrepancy as to opposite signs for the two localities. And in only two of these cases of discrepancy has a season above the normal at Mauritius meant a season below normal at Salisbury three years later.

Further detailed investigation on these lines might be fruitful in results. Another apparently attractive method of attacking the problem of seasonal forecasting of rain is to attempt to solve the period of the cycles between successive extreme maxima and minima rainfalls. Our rainfall records only extend over a period of 27 years for a few stations. This is too short a period to enable us to solve whether any cycles are operating here.

In 1888 Mr. D. E. Hutchins published "Cycles of Drought and Good Seasons in South Africa." In this he claims that South Africa is subject to three rainfall cycles, of different period, working simultaneously, viz. :—

- (1) "Storm cycle, bringing the heaviest rain to western winter rainfalls, but usually only wind to eastern stations. Period nine and ten years alternating." (Russell's nineteen year cycle.)
- (2) "Meldrum's cycle, bringing the heaviest rain to eastern summer rainfalls, but usually little rain to western stations." Period 12.5 years.
- (3) Sunspot cycle. Period 11.11 years.

These three cycles naturally rarely fall due at one time, and it is 126 years since they were so near together as they were in 1916-17. This was a period of extremely heavy summer rainfall in the eastern districts of the Union, but it did not manifest itself until a year later here in 1917-18. As it happens, the year 1917-18 was a year of maximum sunspot activity. It appears that there is a fairly close general relationship with certain discrepancies between the years of maximum and minimum sunspot activity and our years of maximum and minimum rainfall. It is probable that it will be found that cycles (2) and (3) operate in this country simultaneously with other cycles which have not been solved yet. It is clear, however, that this method of forecasting will not enable us to say whether the rainfall in any one individual year will be above or below normal, but will only enable us to state with fair accuracy

whether we are entering upon a wet or dry period of years and approximately when the maximum and minimum will occur.

If Hutchins' theory is correct, the eastern summer rainfall may be expected to be less yearly for some years after 1920, and not appreciably above normal again until 1927-1930. This is unlikely to be correct for this country, as our oscillations for periods consistently above and below normal do not seem to exceed three to four years, but it will be interesting to see in how far the theory is justified.

To summarise the present state of knowledge in this country it would appear:—

(1) That day by day forecasting will not be practical for many years to come.

(2) That seasonal forecasting of the summer rains may be possible if a line of investigation is followed similar to that utilised for the prediction of the Indian monsoon rains. This will probably be found to be the most accurate and reliable method.

(3) The probable date of the arrival of the general rains is very obscure, but detailed investigation might afford a clue.

(4) Comparison of Rhodesian rainfall with that observed in other countries to the east of us some years previously may lead to partially accurate estimates being formed of the type of season probable in Rhodesia year by year, but this method will always be liable to a margin of error in any individual year.

(5) Forecasts based on the rotation of cycles are unlikely to be possible here until our observations cover a longer period. In any case such forecasts are only likely to state the probable dates of successive wet and dry periods of years with a margin of error as to the date of the commencement of such periods.

Arsenical Poisoning of Cattle.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist.

Although reference has often been made to the numerous cases of loss of cattle caused by arsenical poisoning, there still appears to be some laxity in the handling of dipping fluids and the management of dipping tanks, and the annual loss of cattle on farms from this cause is so serious that attention is drawn again to this important matter.

Whilst the number of cases of poisoning, in the diagnosis of which the Chemist has been called upon to assist, is probably only a fraction of those which actually occur, 65 morbid specimens have been received at the Agricultural Laboratory during the past 14 months for toxicological examination. In 60 per cent. of the cases, death was attributable to arsenical poisoning, some of them involving the loss of a considerable number of cattle.

Accidents will sometimes occur in spite of the fact that every precaution is taken, but it is equally probable that a large number of the cases of arsenical poisoning can be avoided. Numerous instances could be cited from the records of the Agricultural Laboratory to prove that the handling of concentrated arsenical dipping fluids is left to natives without responsible supervision. Many samples of dip consigned for testing to the Laboratory as being professedly representative of the solution in a dip tank have, on examination, been found to consist solely of concentrated dip, thereby indicating that the consignor had probably instructed a native to draw the sample, and the native had taken a sample of concentrated dip instead of the solution in the dip tank. In such cases, the person in authority is blameworthy, not only for trusting a native to draw a fair sample and allowing him to have access to a drum of cattle dip without responsible supervision, but probably too for not keeping the concentrated arsenical dip under lock and key.

In cases of arsenical poisoning of cattle, the frequent comments of the unfortunate owners of the cattle are that the source of the arsenic is a mystery; in some this is true, but in many it is not so when enquiries are made as to the care exercised in the handling of dipping fluids and the management of the dip tank. It is therefore proposed to refer to the more common causes of such accidents, and to enumerate the details to which attention should be paid in order to avoid them.

Exposure of dipping solution to the access of stock is one of the common causes of arsenical poisoning of cattle, and the following cases of such are known to have occurred. Cattle have been given free access to ground which has become impregnated with concentrated dip from leaky drums or to ground saturated with solution which has either been splashed over the side of the tank during dipping operations or has overflowed when the tank has become flooded during the rains.

Inefficient drainage of the drying kraals and the consequent accumulation of arsenic is, in some cases, a constant source of danger. In other cases the ground has become heavily charged with arsenic owing to the careless disposal of dip and refuse when the tank is cleaned out, and instances of drums containing arsenic being allowed to lie in the open are by no means rare.

Another source of danger of arsenical poisoning is the excessive strength of the solution in the tank. When such cases occur, the loss of cattle is generally very serious, but accidents of this nature are fortunately infrequent, and should never occur if the person in charge knows, as he should, the capacity of the tank inch by inch (*i.e.*, the volume to the 3 ft. 6 in. level and inch by inch above that level),

keeps a careful record of the volume of solution in the tank, and adjusts any alteration in the strength of the dip, caused by evaporation or entrance of rain water, so as to accord with the strength prescribed by regulation. If such records are kept and adjustments are accurately made, the maintenance of the solution in the tank at the correct strength is assured. Occasionally the adjustment of the strength of the solution may not be possible from the records, owing to the tank having overflowed or become so full of solution during the rains that a portion has to be emptied out; in such cases the strength of the solution will have to be determined by testing it, and adjusted accordingly.

All the aforementioned sources of danger are so obvious that it would appear unnecessary to mention them if experience had not shown them to be so serious.

From the foregoing account it will be seen that the loss of cattle from arsenical poisoning could, in many cases, have been avoided by attention to the following details:—

(1) All drums containing concentrated dip should be stored under lock and key when not required, and kept under responsible supervision whilst out of the store.

(2) Drums, when emptied, should be thoroughly washed out at once and the wash water placed in the dip tank or buried.

(3) In order to correct the strength of the solution to that prescribed for the interval of dipping which is being practised, the capacity of the dip tank must be known, so that the accurate adjustment of the strength for any alteration of volume can be made before each dipping.

(4) Draining pens should be so constructed that dip cannot collect in them.

(5) Precaution should be taken to prevent cattle from licking soil or drinking water which has become contaminated with arsenic, and when drying kraals are used in addition to draining pens, any surface accumulations of water therein should be dispersed before the cattle are allowed to enter them.

(6) When necessary the tank should be protected by drains in order to prevent the flooding and overflowing of the tank.

(7) When the tank is emptied a deep hole should be dug, into which the dip and refuse can be placed. Refuse taken out of the tank at any time should likewise be buried.

Poultry Husbandry.

THE INCUBATION AND REARING OF CHICKS.

By A. LITTLE, Poultry Expert.

The most suitable period in Rhodesia for the incubation of chicks is from the beginning of April to the end of August, and if the chicks are carefully looked after and allowed no set-back, it can be continued to the end of September. After this month they are more difficult to rear, being as they are frequently rather weakly, and thus more subject to attacks of insects, more affected by wet weather and more likely to contract any disease that may be present, especially warts or chicken-pox, which is very prevalent from September to February. Provided, however, they are well grown and healthy before this period, they are able to withstand these.

The Natural Method of Incubation seems to be preferred by many poultry keepers from the mistaken idea that chicks hatched in this way are healthier and that better hatches are obtained. Artificial incubation is practically as good as the natural method, *provided* (1) the breeding stock are good; (2) that they are properly treated; (3) that the attention to the eggs and incubator is carried out with care; (4) that the chicks when hatched are given a chance.

Even those who use incubators should also have broody hens waiting to receive odd settings of eggs which would become too old by the time the incubators are ready for them, for eggs should not be put into an incubator if they are more than a week old or at the most ten days old. Eggs more than ten days or at latest fourteen days should not be put under a hen. Only the good sized, good shaped, clean eggs should be reserved for hatching, and these, while waiting, should be kept in a cool, sweet-smelling, airy place and turned once a day. Eggs bought for hatching should be rested for 24 to 36 hours after arrival, and not put immediately under the hen or into the incubator.

The poultry keeper would do well, shortly before the hatching season commences, to purchase as many hens as he thinks he requires for the season's hatching, *i.e.*, hens of a heavy breed. Birds of the light breeds will sometimes become broody, but they are most unreliable sitters and mothers, as also frequently are crosses of heavy and light breeds. Such fowls when bought should be dipped at once and isolated for a week. When they become broody place them on three china eggs in a comfort-

able quiet place, and they will then be available when the hatching eggs are ready. Some big breeders have often 20 to 30 of such hens waiting.

Care should be taken when making the nest; the hen herself does so when she steals in. We cannot expect a good hatch if the hen is dumped down in a dirty house, in an old box with a dirty nesting material, or in a noisy place where other fowls are always disturbing her. Choose a place that is cool, fairly dark, quiet, free from insects, the air of which is pure.

The sitting coops can be made of a square box which gives the hen ample room to move, with the floor and front taken out. On the floor some small mesh wire netting should be tacked, and on the front a small mesh wire door, making her secure from the depredations of dogs, cats, snakes, etc. On the wire netting floor place some moist earth scooped out into the shape of a saucer, and over this dust some insect powder. On this place dry hay, straw or chaff, and again use the dusting powder. Put the three china eggs in and place your broody hen on these *after dark*; if she sits well for two days, on the third night carefully remove the china eggs and slip under her the eggs to be hatched, having warmed them slightly in a little lukewarm water. Put in front of her each day some clean water, a few mealies, grit, charcoal and just a little green food; this should be done at a certain time each day, preferably in the morning. See that the hen comes off the eggs, for they will require cooling, and fresh air allowed to pass through the pores of the shell to the developing chick. The majority of poultry keepers do not allow the eggs to air and cool long enough; obviously on hot days the eggs can be left uncovered longer than on cool or cold days. A good test is to place an egg on the upper eyelid, and when the egg feels cold, the cooling and airing are sufficient. On the seventh day and again on the fourteenth the eggs should be tested and the unfertile and addled eggs removed. The former lower the temperature of the others, and the addled eggs give off foul gases and cause bad hatches and weak chicks. This is a point to which it is necessary to draw the attention of both purchasers and sellers of eggs for hatching. The seller should mark every egg sent out with a private stamp in indelible ink, and if he replaces unfertiles (the rule is the same price for 12 or 13 eggs, unfertiles replaced, as for 15 or 16, unfertiles not replaced) stipulate that these be returned on the tenth day. Although one can hardly credit it, yet many are still under the idea that the eggs that do not hatch are unfertile. These may be addled, the yolks may be broken, etc., and therefore do not hatch. The cause of a bad hatch is usually put down by the purchaser to the eggs, and yet when sent out they may be excellent hatchable eggs, but, due to rough handling in transit or the purchaser not treating them and the setting hen as they should be, a bad hatch is the result. Of course the purchaser does not lay the blame on himself; on the other hand, if the hen and eggs are properly treated, then the blame can be laid upon the purchaser's breeding stock or rough handling in transit.

As soon as the eggs begin to hatch the hen should be disturbed as little as possible until the chicks are noticed moving out from under

the hen. Then take each one, dust it slightly with a little insect powder and rub just a smear of grease on its head; a very little suffices. Dust the hen herself well, and also allow her to dust herself in the earth on in a dust box. Have a coop ready, a clean roomy one with slats in front, between which the chicks can run in and out; also in front of this again a small mesh wire netting door, which should be kept closed at night, thus preventing the ingress of vermin. On the floor of the coop should be a fair depth of dry hay or straw, and in front of the coop there should be a small mesh wire netting movable run, and this and the coop should be moved on to fresh ground *each morning*. For the first week the hen should not be allowed out with the chicks, otherwise she will run them off their legs before they are strong enough.

Artificial Incubation.—It is not advisable for those who have only a few fowls to go in for this method, for unless an incubator can be filled at one time with eggs not more than a week old, the expense is not warranted, and broody hens should be used. Unless the breeder has sufficient eggs to fill an incubator each week, broody hens are still necessary, that is, if only one or two incubators are used. Three, of course, will give one hatch a week from eggs not more than a week old.

Certain types and makes of incubators are more suitable to some districts than others; for instance, the moisture incubator, such as Hearson's, Tamlin's, The Buck Eye, The Phipps, etc., will run well in capable hands anywhere, either in a moist or dry climate. On the other hand, the hot air incubator, such as The Cyphers, The Prairie State, The Cycle, etc., is only adapted to moist climates.

If a new incubator is purchased, see that everything is in order before starting to heat up. If it is a second-hand one, see or get someone to ascertain for you that it is in good working order and perfectly clean. It should also be cleaned and disinfected after each hatch, and at the conclusion and commencement of the hatching season. This cleaning and disinfecting should be carried out as follows:—First scrub well the inside and all movable parts with soap and a solution of warm water and a disinfectant, then put out in the sun to dry (the sun also being one of the best germicides we have). Then put in all parts, close up the ventilation holes, light the lamp, and in a saucer placed in the water tray put a teaspoonful of Formalin; keep the incubator shut for 24 hours, then open and air well. Now regulate the temperature up to 102½ deg. F.; this can be more quickly done if the ventilation holes are filled with cotton wool or linen.

As soon as the temperature has been running regularly for 36 hours, place the eggs in the drawer, having first warmed them in the drying box. I find that turning the eggs once a day is necessary, but cooling and airing must be sufficiently and properly carried out as mentioned above under natural incubation, if a good hatch is to be obtained. Sufficient moisture in the incubator and around the incubator is also absolutely necessary. I prefer to dispense with the hessian in the water tray. This should be kept full, and by frequently changing it kept sweet and clean. As mentioned under natural incubation, the eggs

should always be tested on the seventh and fourteenth days. The eggs should be turned for the last time on the eighteenth and cooled on the nineteenth; the drawer should then be shut and not opened till the morning of the twenty-second. This should be quickly done, and the chicks taken out and put into the drying box and the drawer again shut and not opened till the morning of the twenty-third, when all eggs not hatched should be destroyed, as the chicks in them will not make good, strong, vigorous birds.

Allow the chicks to have a good long rest and sleep in the drying box, and during this time they should not be disturbed on any account; they require it, and it assists them to start life well, otherwise they are badly handicapped from the start. As soon as they begin to get lively take them out and put them into a paraffin box brooder, which should be quite ready for them and perfectly clean, well disinfected, and comfortable. Such a box will hold 50 chicks up to a week old; after this time it becomes too small and the chicks become overcrowded. Half should then be placed in another brooder. Overcrowding is one of the chief causes of weakly, poor, stunted chicks; few poultry keepers, nevertheless, seem to realise this. Attached to this brooder there should be a small movable wire netting run, and this and the brooder should be moved on to fresh ground each morning.

Feeding.—The feeding of incubator and naturally hatched chicks is identical. For the first 36 hours they should have *no food* at all, but in front of them should be placed a little coarse sand or fine hard sharp grit and a little charcoal (finely granulated); allow them to eat their fill of this. There should also be available a little clean cool water. The first meal should consist of rice boiled in separated milk and then squeezed out dry, or bread crumbs treated in the same way, subsequently small grains in fine litter one to three inches deep, such as crushed mealies, broken wheat, munga, linseed (to help growth of feathers), crushed sunflower seed, a little oatmeal or groats, manna, etc.; practically any small grain will suffice, provided there is variety and the chicks have to scratch for it. This can be put in the litter in the morning, and not renewed till it is finished. The old-fashioned method of feeding every two hours a day is not necessary, nor are chopped up egg and bread crumbs. In a box from which the chicks can help themselves as they wish should be placed a mixture of bran and mealie meal. From the very first in a receptacle into which they cannot get and so make themselves wet should be placed thick separated milk, and of this they should have as much as they will take. Of green food of all sorts, chopped small, the chicks cannot have too much, the best being onions and onion tops, lettuce, sunflower leaves, sow thistle, lucerne. Of course grit, charcoal and clean cool water should always be available. This method of feeding suffices till the birds are nearing maturity. If it is possible without loss from hawks, wild cats and other vermin to run them on free range, the rearing is less expensive, entails less labour and usually produces better birds.

The main points in hatching and rearing are:—Cleanliness; attention to details; system; punctuality and regularity, in hatching; care of the eggs; an even temperature both in and around the incubator;

sufficient moisture; ample airing and cooling; removal of the unfertiles and bad eggs; cleanliness in the incubator and nest and their surroundings; and pure fresh air. In rearing, sleep and rest for the first 36 hours as well as no food; cleanliness and freedom from insects; pure air; avoidance of overcrowding or getting wet; plenty of scratching exercise; plenty of green food and much separated milk; strict attention to the grit, charcoal and water.

Makoni Poultry Club.

A Poultry Club has been formed for the Makoni district, holding a meeting on the second Saturday of each month. The following is a syllabus of lectures to be delivered:—

April.—Care of chicks and method of feeding to month old. Construction of coops, brooders and other appliances.

May.—Treatment of growing stock, grading of cockerels, anatomy and physiology of fowls. Demonstration: *post-mortem*.

June.—Feeding for vigour, egg production and table; chemistry of foods and feeding.

July.—Poultry diseases and their prevention; diseases caused by damaged foods, with demonstration of normal and abnormal organs and damaged foods.

August.—External and internal parasites, with practical demonstration of specimens; poultry pests and their eradication.

September.—Breeds: egg producers, general purpose and meat; treatment and selection of those most suitable for purpose.

October.—Marketing, records (pedigree, stud and egg), accounts, advertising.

November.—Treatment of birds in moult, organisation of the egg industry, co-operation, preservation of eggs and bye-products, cold storage.

December.—Exhibiting, scoring and judging.

Hints on Brickmaking.

By G. T. DYKE.

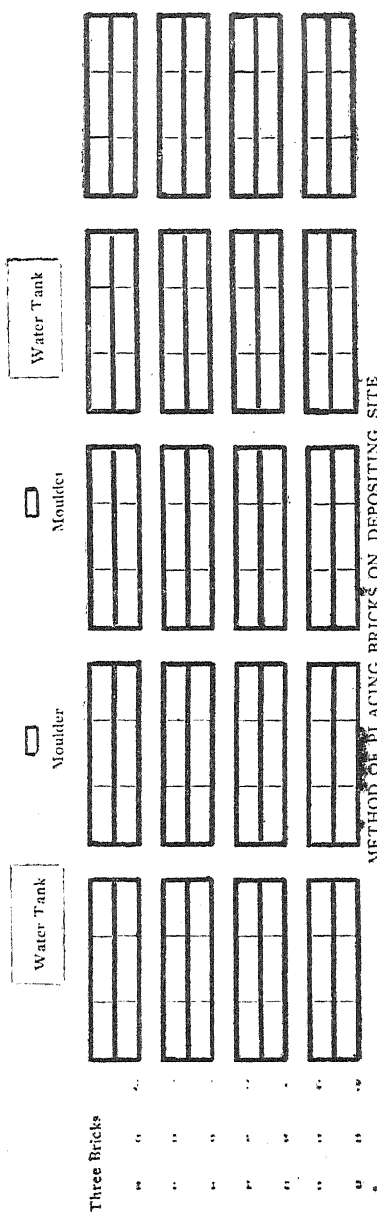
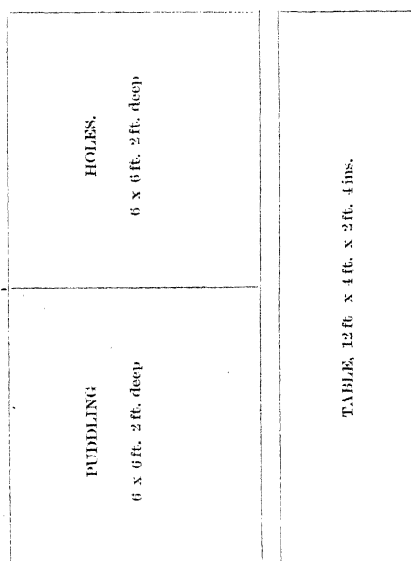
[This article is reprinted in consequence of numerous requests for information on the subject. It will be noticed that a kiln of a more simple design has been substituted for that which previously appeared. —Ed.]

Having had some practical experience in the manufacture of bricks, and having seen Staffordshire blues, Adderley Park reds, Stourbridge fire bricks and Ruabon terra cotta made by hand and also by the most up-to-date machinery, as well as thousands of bricks made in the Transvaal, I am perhaps able to give a few hints to those who desire to make bricks for their own use.

First, I would impress upon all who intend making bricks that success in brickmaking, like everything else, largely depends on the maker being thorough in every detail from start to finish. I mention this, as I have seen more than one failure through lack of interest and the leaving of all the work in the hands of kaffirs.

The prevailing idea of the amateur in this country is to make his bricks of antheap. Good bricks can be made from this material, but when a large quantity is required, one cannot go to the expense of carting antheap, or making bricks wherever the antheaps happen to be. Both in this country and in the Transvaal I have found yellow clayey sub-soil to be the best material for the manufacture of bricks, and I believe there are very few farms on which it is not to be found. In no case should the top soil be used, as the bricks are sure to crack if it is. To good yellow sub-soil should be added clean, sharp sand; ratio, three parts sub-soil to one part sand. I have found sand from the mines to be excellent. Particular care and attention should be given to the mixing and puddling of the material.

Excavate one hole in the ground 2 ft. deep x 12 ft. x 6 ft. wide, with one sheet of galvanised iron on edge across centre, placed in such a manner as to form two equal compartments, each 2 ft. x 6 ft. x 6 ft. Mix the dry sub-soil and sand at the side of the holes before adding water, and when well mixed put into the holes and add water as required. Put two boys to stamp it into a thick pasty mass, always remembering you cannot puddle it too much. Have a good strong deal table made, 12 ft. x 4 ft. x 2 ft 4 in. high, and place same at the edge of the hole, so that the clay, as we will now call it, can be readily placed on the back of the table with a shovel; always keep the top of the table wet when making.



METHOD OF PLACING BRICKS ON DEPOSITING SITE

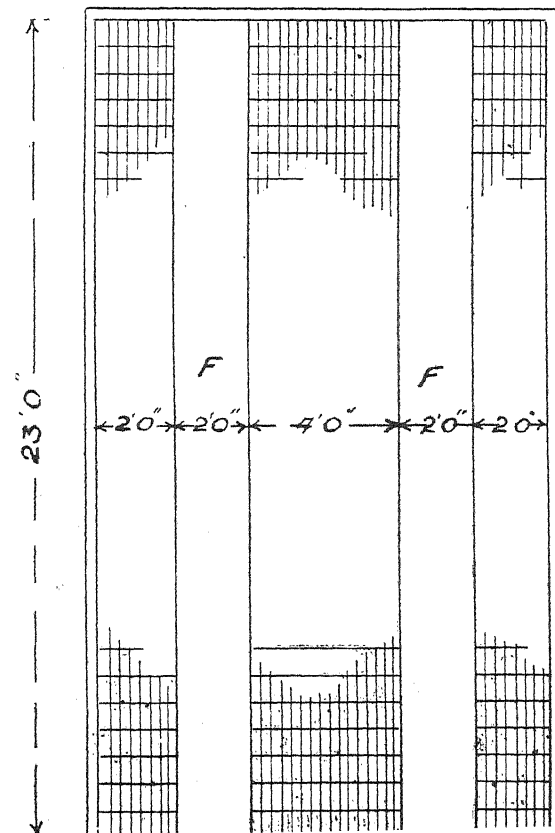
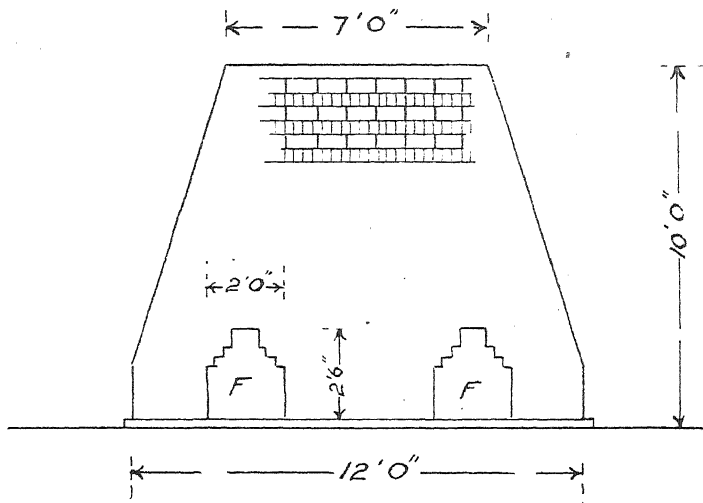
Moulds.—These can be best made of well-seasoned floor boards, large enough to hold three bricks. The inside measurement of each mould should be $9\frac{1}{2}$ in. long, $4\frac{5}{8}$ in. wide, by $3\frac{1}{2}$ in. deep, which size allows for shrinkage in drying and burning. The finished brick will be 9 in. x $4\frac{1}{4}$ in. x 3 in.; the moulds should be very smooth on the inside, quite square at the corners, and parallel from top to bottom. I should advise anyone who is not a good hand at carpentering to have the moulds made by a competent workman. A galvanised iron tank or ordinary bath should be placed at each end of the table, as shown in diagram, and kept well filled with water, into which the moulds are put as the carriers bring them back after depositing the bricks on the drying floor. A large space should be cleared on which to deposit the bricks when made, and great care must be taken to have the surface level and smooth, otherwise good-shaped bricks cannot be expected. Supposing these preparations to have been made, we are now in a position to commence making the bricks.

Two boys can work at a table of the dimensions given. The clay in hole No. 1, being ready for use, is dumped on the table; each moulder takes a set of moulds from the water tank, dusts them with fine sand, then takes a portion of the clay and slaps it into the moulds, taking care to ram it into the corners. Next draw a straight edge across the top, and the mould is then ready for the carrier to take away to the depositing site. Each moulder should have two boys to carry the moulds away. When the mould is filled with clay, the carrier should run with it to the drying ground and deposit the bricks by carefully turning the mould upside down, and then return and put the mould into the water tank, by which time another mould should be ready for him to deal with in the same manner. When the boys have once got used to the work, two makers should easily turn out 1,000 bricks per day.

After the bricks are laid on the drying floor, they should be lightly covered with grass or straw. Each day's work will be ready to stack the following morning. The bricks should be stacked on edge with a small space between each brick so that a current of air can pass through and assist the drying process. The stacks should be turned at the end of three days, and in six days should be ready for burning. Care should be taken to put a covering of grass or straw over the stacks to keep off the direct rays of the sun, otherwise the bricks will crack. *Re* method of placing bricks on drying ground, puddling holes, table and tanks, see sketch.

The following are the chief points to be observed:—

- (a) Good yellow sub-soil mixed with sand, three to one.
- (b) The more the clay is puddled the better the brick.
- (c) An addition of fine sifted wood ash improves the brick.
- (d) In no case should any gravel or stones be mixed with the clay.
- (e) Moulds to be put into water tanks every time after removing brick.
- (f) Dusting moulds with fine sand ensures bricks leaving readily.
- (g) Bricks must be covered with grass or straw to prevent sun from cracking them.



- (h) A clean, level depositing site ensures a good shape.
- (i) Puddle fresh clay in one hole, while using mixed clay from the other.

A kiln from which about 20,000 good red bricks would be obtained is illustrated in the figure.* The bricks are close packed on edge, the lengths of the bricks in any one course crossing the lengths in adjacent courses at right angles. The fuel chambers F are carried right through the kiln, and are stepped in on top to form a closure. The fuel should consist of hard wood logs not less than 4 inches diameter, and should be closely packed in place with a few wood chips underneath, at the time of building the kiln. The whole of the outside of the kiln should be well covered with dagga, the top being covered with ashes or old corrugated iron well covered with dagga. After the fires are ignited the ends of the fuel chambers should be bricked up and also closed with dagga. The fires will require attention about every eight hours, the ends of the fuel chambers being opened for stoking, and closed again immediately afterwards. The fires will be kept continuously burning for about three days and three nights, the top of the kiln becoming red hot by the time burning is completed.

Canned Meats.

EMPIRE GOODS FOR BRITISH MARKETS.

Among other businesses that the War has served to develop in Great Britain is that of canned meats, and a few remarks on the position in which this trade finds itself at the present moment may be helpful alike to marketer and producer.

The particular reference of this article is to the claim which Colonial canned meats have shown themselves to have on the British consumer in relation to the foreign article. The grocer and the cooked meat retailer, who to-day are the selling media of these commodities, may, perhaps, be forgiven for partial failure to realise that in the Colonial

*From "Buildings and Building Construction in South Africa," by W. S. Cleghorne.

meat there is a tinned product as acceptable and valuable to the consumer as any foreign competing goods, and, therefore, an article worthy of preference from the British point of view. The foreign competitor has in the past gained his advantageous position in the canned meat trades by his keenness and general enterprise in methods. From South America, in particular, there has been built up an import business in canned meats into this country, mainly on the accepted principles of the big North American meat firms which have by the regularity of their service and thoroughness of their method often stolen a march on their British conferees. But that is no reason why Colonial canned meats should not take a forward move, and a decided predominance over the foreign tinned meats in the future, for the Colonial pack has much in its favour. It remains for the Australian or other Colonial producer to do his share in emphasising this advantage to his customer, the grocer in Britain. Taking first a factor which, perhaps, ranks last in sheer importance to the consumer, namely, that of labelling the goods: Australian canned meat packers apparently are still, as a class, unaware of the value of a good attractive label in the selling market. An instance where a line of Australian canned goods actually slumped in sales on its being re-labelled in a superior way affords some proof of the fact that Australians themselves are uninfluenced by the label, but grocers in Britain find the situation very different from this. Some of the best meats from Australia come under a very different label, and as a selling article they are thus placed in an inferior position beside the Plate brands, which are resplendent in their four-sided and multi-coloured label. Along beside these, the Australian tin, with its single panel or strip label, cuts a poor figure, however good its contents. Several of the bigger houses on this side, realising this, re-label Australian meats on their arrival here, and successfully sell them year in, year out, under their own proprietary brands. But this does not do fullest honour to Colonial meats as such, and the grocer awaits the time when the producers will remedy this for themselves.

Colonial canned meats bear a Government guarantee which accompanies all exports. For instance, no canned meat leaves Australia without an official guarantee of quality. Under the Commerce (Trade Descriptions) Act, all meat for export is subject to official inspection at the works, and every consignment is accompanied by a certificate, indicating, in addition to the grade, the name of the packing establishment and the date of the pack. There are only two gradings—officially known as first and second quality. Private marks are made by which the representatives of the Commonwealth on this side of the water may determine whether any pack is really of Australian origin, or only a colourable imitation. Such precautions are necessary from every point of view.

Apart from the quality of the meat, packing and shipping are controlled by the authorities to this extent, that there is power to interfere with over-looseness on the one hand, and with over-tightness on the other, in the transport arrangements, all of which must be in accordance with hygienic requirements. Such regulations are necessarily utilitarian, and official control stops short of what may be called the artistic side of packing and marketing.

Of Australia it may be said that practically every freezing works has its canning department, and that, in addition, there are several other houses which confine themselves to canning and the like. Meat is canned in larger or smaller quantities in all the Australian States and in New Zealand, the Commonwealth leading in beef, and New Zealand in mutton. On the Continent, Queensland heads the list with eleven canned meat works registered by the Commonwealth Government, and of those establishments all but one are associated with freezing works. New South Wales is a good second, with ten registered canned meat works. Victoria has five, and South Australia, the Northern Territory, Western Australia and Tasmania have one each, making thirty in all.

Official figures as to the output of these works are not very recent, but a rough idea of the relative packs of some of the States may be obtained from the appended Government statement for the financial year 1916-17:—

	cwts.
Queensland	222,763
New South Wales	75,816
Victoria	20,075
South Australia	1,058

Total, so far as ascertained ... 319,712

In addition to the foregoing, there was in the same year an output of 9,358 cwts. of tinned rabbits from New South Wales, and of 2,540 cwts. of salted meat from Queensland. There was also a large output of tinned rabbits from South Australia, with regard to which no useful figures, official or otherwise, are available.

The net export of Australian preserved meat in tins in 1916-17 amounted to 21,922,630 lbs., and in 1917-18 it rose to 43,036,310 lbs. Those large figures, compared with which current exports are small, were due almost entirely to the necessities of the War. Vast quantities of canned meats were required for the fighting forces of the Allies, and everything was done through Governmental channels. The British War Office was in intimate touch with the Office of the High Commissioner for the Commonwealth in London; gigantic contracts were made, and to a large extent our battles were fought on that sort of food, which proved both toothsome and nourishing. The military authorities insisted very properly upon a very high standard of quality, and Australia at any rate rose to the occasion.

It is interesting to compare the War prices with those obtained before and since. Just before the outbreak 40s. was the average price for twelve tins of beef of 6 lbs. each. By 1918 the price for first quality had been inflated to 130s., and even when control was instituted it was 107s. At the present time the price (with control off) ranges from 65s. to 82s. 6d., according to quality and market conditions.

All the War Office contracts have now expired. When the Armistice came the Commonwealth Government was negotiating to contract for three to four million 12 oz. rations (of canned meat) per month for the troops in Egypt.

There are still contracts running with the Admiralty, for canned meat in large quantities is an essential requirement of the Navy at all times. Those contracts are made independently of the High Commissioner's Office. It is a feather in the cap of Australia that on all occasions the Admiralty supplies were drawn from that part of the Empire. Only the best cold-pickle is accepted, and indeed none other is ever offered.

During part of the War the meat was put up in 12 oz. tins to suit the Army ration, but later on, when labour conditions became acute, the War Office accepted 6 lb. tins—twelve in a case. The relative labour of filling and soldering a 6 lb. tin is obviously less than that of dealing with a smaller one. For the purposes of general trade the filled tins are now usually 6 lbs. in weight. That is all very well in normal times, but in present conditions exporters might with advantage consider the question of putting on the European market more 2 lb. tins. The psychology of the housewife is an important factor in such matters.

As has been stated above, American methods have resulted in Colonial canned meats facing the hardest competition in the British market, and the Board of Trade returns of imports reveal this in striking fashion.

Let us look at the general figures. Last December there were imported into the United Kingdom 70,863 cwts. of beef officially classed as "tinned, canned, extracts, etc., including tongues." That quantity shows a remarkable drop from the corresponding month of 1919, when the total was 173,866 cwts.

Taking the whole twelve months of 1920, we find that the weight of these sorts of beef imported was 760,930 cwts., as compared with 2,566,378 cwts. in the corresponding period of 1919, and 647,938 cwts. in that of 1913. The value of twelve months' imports in 1920 was £6,427,454, as compared with £20,967,431 in the like period of 1919, and £2,692,443 in 1913.

The figures for tinned or canned mutton and lamb are these:—December, 1920, 8,658 cwts.; December, 1919, 15,311 cwts.; December, 1913, 6,906 cwts. Twelve months ended on 31st December last, 147,127 cwts.; ditto, 1919, 202,350 cwts.; ditto, 1913, 86,223 cwts. The value of last year's (1920) imports was £928,000, as compared with £1,551,515 in 1919, and £204,034 in 1913.

These statistics go to show that although the canned meat trade is at present languishing, in comparison with the abnormal demand created during the War, yet it is on the whole a bigger thing than it was immediately before the War.

It may be interesting to add that, on the other hand, the imports of "tinned or canned" rabbits show a pronounced downward tendency, as the appended figures prove:—December, 1920, 4,544 cwts.; December, 1919, 26,152 cwts.; December, 1913, 6,180 cwts.; twelve months of 1920, 117,703 cwts.; of 1919, 494,201 cwts.; of 1913, 154,844 cwts. The total value is, however, greater, being £1,156,562 in 1920, as against £810,577 in twelve months of 1913.

It must not be assumed that all the canned meats covered by our imports are consumed in the United Kingdom. The re-exports are, and have been for some years, considerable. They are thus officially indicated:—December, 1920, 999 cwts.; December, 1919, 2,612 cwts.; December, 1913, 3,175 cwts.; twelve months of 1920, 26,434 cwts.; of 1919, 20,918 cwts.; of 1913, 33,746 cwts.—*Imperial Food Journal and Empire Produce News*.

Correspondence.

FAT STOCK SALES AT GWELO.

To the Editor,

Rhodesia Agricultural Journal.

Sir,

In your issue this month, article, "Fat Stock Sales at Gwelo," page 101, one part is not right and very misleading to your readers. "At Mr. A. E. White's fat stock sale at Erin-go-Bragh, held on 3rd December, the first prize of £80 was awarded to Mr. J. R. Stewart of Shangani, and the second to the Trevelloe Estate, thus reversing the decision given at the sale just mentioned." Mr. Editor, in putting anything like this in print, you should make the thing clear. At the previous sale you mention the classes were for six oxen and pairs. At Mr. White's sale it was for eight oxen only. The six that won the 100 guineas were not shown at Mr. White's sale, but the six that were second with two others added made the eight at Mr. White's sale. Therefore I cannot understand how you make out that the decision was reversed. Not that only; you don't give Trevelloe Estate credit for winning the championship, which was done by a South Devon-Africander, and also one of this cross was reserve.

Yours, etc.,

THOS. BRADSHAW.

Trevelloe Estate, Shangani,
20th February, 1921.

Reviews.

A HANDBOOK ON COTTON AND TOBACCO CULTIVATION.

An addition to the literature relating to tobacco and cotton culture has recently been published by the Government Printer, Zomba, Nyasaland. The book is written by J. Stewart J. McCall, P.A.S.I., C.D.A. (Glas.), Director of Agriculture for Tanganyika Territory. Mr. McCall was for some years Director of Agriculture in Nyasaland, and the rapid expansion of tobacco and cotton culture in that Protectorate is largely due to his initiation and administrative ability.

The handbook, which is intended as a guide to prospective settlers, is written in popular style, but conveys accurate and concise information as to technical details. Although the publication deals primarily with cotton and tobacco culture in Nyasaland, it contains much information of interest to Rhodesian planters. In the first chapter the handbook deals with the history and importance of cotton. Mr. McCall points out that with the exception of Egypt cotton growing in Africa is still in the experimental stage, but that the future possibilities of extension in Africa are even greater than those of America. In regard to the development of cotton growing in Africa, the author states the position concisely in the following paragraph:—"The experiences of the last fifteen years have amply demonstrated that cotton can be grown in considerable areas of British Africa, but as one connected with this pioneer work since 1904, I have no hesitation in saying that, whereas irrigation was the foundation of cotton growing in Egypt, internal railways, cheaper freights and more numerous small ginneries are the necessary foundation for the successful establishment of African Empire cotton growing."

As regards climatic conditions suitable for cotton growing, Mr. McCall states that "Ideal conditions exist when the daily temperature is between 70 deg. and 90 deg. F.; temperatures of 100 deg. to 112 deg. check transpiration and are certainly excessive during the growing season." He further states that, "Provided the rainfall is reasonably distributed, 35 inches in the growing season, even under tropical conditions, is ample for the crop, and where the rainfall is in excess of this it is essential to have the land well drained." These climatic conditions are very closely approximated in several districts in Southern Rhodesia.

The handbook deals with the various cultural operations in a clear and comprehensive manner. The remarks relating to cotton breeding are of especial interest and also apply to other crops. The author states:—"In the report of the Agricultural Department, Nyasaland, for 1910, reference was made as to the possible hereditary character in strength and length of staple, but further investigation extending over

the last four years, with cotton selections from the same individual plants grown in varying conditions and elevations, points to the fact that such desirable qualities are largely affected by soil, climate and rainfall, and cotton with 1 3-16 inch staple and described as strong and silky, when transferred to the lower and more tropical regions of the Shire valley, with deficient rainfall, degenerates in a single season to a staple of 1 inch to 1½ inch, and loses a large degree of its strength and lustre. One is therefore forced to the conclusion that the real benefits of selection can only be obtained by selecting for local conditions, and that there is little value in selecting at elevations of over 5,000 feet to improve the character of a crop to be cultivated commercially at elevations below 500 feet."

The author, in pointing out the danger of insect pest, states that the greatest enemies of the cotton planter in Nyasaland are three species of "Bollworms," which reduce the yields of cotton by 20 to 70 per cent. Preventive and remedial measures are laid down for dealing with the several pests.

That portion of the handbook dealing with tobacco culture should be of especial interest to Rhodesian planters. The progress of the tobacco industry is indicated by the fact that in 1899, when the first crop was grown, the value of the leaf produced was £47, whilst the Customs returns for the year ended 31st March, 1920, show that the export value of the crop was £271,000. The tobacco soils of Nyasaland, as pointed out by Mr. McCall, vary from light sandy loams to stiff, red clays, and are characterised by being comparatively rich in potash, normal to slightly deficient in phosphates, and poor in nitrogen. The author states that "the heaviest crops are generally reaped off virgin land or comparatively new clearings, but the tobacco plant is such a voracious feeder that four years' continuous tobacco cultivation practically reduces all Nyasaland soils except the heaviest clays to such a state of poverty as to render them useless for tobacco growing until they are green manured for a year or allowed to revert to natural grass and weeds for not less than two years. . . . Before leaving the question I would state that continuous tobacco growing for a period of four years on the same soil is not advocated." These observations apply with equal force to Rhodesian soils. The general directions as to cultivation and curing are much the same as are practised in this Territory. In regard to capital outlay Mr. McCall estimates that the total outlay on buildings to handle 100 acres of tobacco would not be overestimated at £600. This figure might also be taken as a maximum for Southern Rhodesia.

The author aptly remarks that "The home tobacco market is a difficult one for a new country to get a footing in, and I am proud to state that Nyasaland is the most serious and successful competitor that has ever competed with American-grown 'bright' tobacco, yet I fully realise that many obstacles have to be overcome before our new industry will be on an equal footing with the long established tobacco industry of America, and our watchword for the present should be 'Steady progress based on sound quality rather than excessive tonnage,' increasing our output as our product becomes appreciated by the British public, and on no account overstocking the market before it can be absorbed,

especially with lower dark grades." This warning to Nyasaland tobacco growers should receive the careful consideration of tobacco growers in this Territory.

Copies of the handbook on cotton and tobacco culture can be obtained from the Government Printer, Zomba, Nyasaland, at 5s. 3d. per copy, post free. Farmers interested in these crops would be well advised to obtain this publication.

[Since the above was written news has come to hand of the demise of Mr. McCall. His death at the early age of 37 cuts short a career of great promise, and will be greatly deplored by his many friends in Rhodesia.—Ed.]

"THE CHEMISTRY OF CROP PRODUCTION."

By Professor T. B. Wood, C.B.E., M.A., F.I.C., F.R.S. Tutorial Press. 5s. 6d.

Professor Wood's book of the above title assumes on the part of the reader a certain knowledge of chemical materials and functions, and deals more particularly with the application of scientific principles in the working of the mixed farms of the British Isles. For these reasons it appeals more particularly to the English student than to the average Rhodesian farmer.

But although circumstances may vary locally, the fundamental scientific principles underlying the maintenance and improvement of soil fertility are universal. These principles are most ably and clearly expounded in the work under review. The composition of soils; the dependence of fertility upon chemical, physical and bacteriological factors, and how these are sustained by manures and cultural treatment; the demands which particular crops make upon soils and how these demands are most suitably met by different fertilisers; the composition and valuation of fertilisers; the important role which lime plays in soil economy; the principles underlying green manuring, rotation crops and dry farming; all these important and interesting points are simply and clearly explained.

The intelligent reader will realise that the numerous factors of productivity—chemical, physical and bacteriological—are connected "like the links of a chain, the strength of which is the strength of the weakest link." Nor will he expect the Government Chemist to be able to give the best possible advice upon a small sample of soil, concerning which no information is supplied as to origin, environment, depth, drainage and other field conditions which affect the natural fertility of a soil.

A. W. F.

The Agricultural Outlook.

The season, which opened rather adversely, turned out subsequently to be one of the most favourable we have experienced, as the rains, though constant, were seldom heavy enough to produce much erosion of soil. The maize crop recovered in a remarkable way, and a good harvest is assured. In the case of some short season crops early sowings were unfortunately lost, and the late sowings have not reached normal development. The tobacco crop has done well, and growers are now actively engaged in curing. Generally speaking the quality of the leaf appears to be better than that of last season, although in some cases the cured product is badly perished through bacterial spot and by white rust. It is anticipated that the crop will be considerably larger than that grown last year. Turkish tobacco will probably be a smaller crop than that reaped last season, but it is expected that the quality will be better, as this type of leaf is now being grown principally by growers experienced in its production. For low grade Turkish tobacco there will be practically no demand in South Africa this year. A new system has been adopted at the Tobacco Warehouse this year in regard to advances on crops sent in. In the case of leaf which has been roughly graded the grower will be paid out 75 per cent. of its value, but on properly graded leaf 90 per cent. will be paid out as soon as it has been classified.

Owing to the dry period at the beginning of the year the grass has seeded late, and the hay crop should be of good quality. Hay making is in full swing, and a pleasing feature is the increasing number of stock owners who are making provision for the winter by the storage of ensilage and the stacking of hay. A marked advance also is the practice, now becoming quite common, of augmenting the supplies of manure by the utilisation of liberal quantities of veld grass for the littering down of stock.

Cattle are in good condition, mortality is low and the rate of increase is being well maintained. The veld generally is in excellent condition, and there is every prospect of cattle wintering well. The prices for slaughter and breeding stock have sagged, and with the Rand well supplied with beef from Union sources, our export trade has of late fallen off.

A good many farmers are preparing their lands for winter cereals, and the indications are that the acreage put under these crops will be considerably larger than it was last year. Anyone requiring information regarding the growing of winter wheat should apply to the Department of Agriculture for Bulletin No. 372.

Southern Rhodesia Veterinary Report.

December, 1920.

AFRICAN COAST FEVER.

UMTALI, GWELO AND MAZOE DISTRICTS.—No cases during the month.

MELSETTER.—On the 8th instant the Government Veterinary Bacteriologist diagnosed African Coast Fever from smears taken from a dead beast at Quagga's Hoek. The local District Veterinary Surgeon reports that on inspection he found five animals had died from the disease. Three animals were destroyed on temperature, making a mortality of eight for the month.

MATOBO DISTRICT.—Twelve deaths are recorded from the Figtree centre of infection. No deaths from this disease at Sauerdale.

QUARTER-EVIL.

The following mortality in cattle was reported:—Insiza, 2; Gwanda, 4; Antelope, 71; Bulawayo, 3; Belingwe, 2; Essexvale, 12; West Nicholson, 20; Plumtree, 21; Victoria, 10; Umtali, 32; Salisbury district, 12.

CONTAGIOUS ABORTION.

A fresh centre of infection is reported from Gwelo. Further outbreaks reported from Marandellas and Salisbury districts.

HORSE-SICKNESS.

One case occurred in Gwelo district.

EPHEMERAL FEVER OF CATTLE (3-day sickness).

A few cases reported from Victoria and Melsetter districts.

ARSENICAL POISONING.

A considerable mortality from this cause was reported from the Mazoe, Bulawayo, Umtali, Hartley, Gatooma and Salisbury districts.

IMPORTATIONS.

From the Union of South Africa:—Bulls, 27; cows, 31; donkeys, 30; horses, 72; mules, 27; goats, 390; pigs, 19; sheep, 2,039. From the United Kingdom:—Bull, 1; horse, 1; pigs, 5.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, *via* Liebig's Drift, 283; *via* Bulawayo and Plumtree, 176—459. To Northern Rhodesia:—Mules, 4; pigs, 4. To the Belgian Congo:—Sheep, 135. To Portuguese East Africa:—Horses, 20; mule, 1; donkeys, 8; oxen 101; bulls, 3; cows and heifers, 3; slaughter cattle, 69; sheep, 80.

January, 1921.

AFRICAN COAST FEVER.

GWELO AND MAZOE DISTRICTS.—No cases during the month.

MELSETTER DISTRICT.—One case occurred at the Tilbury Estate; none at the other infected centre, Quagga's Hoek.

MATOBO DISTRICT.—Fifty-two deaths occurred at the Figtree centre and four at Sauerdale.

ANTHRAX.

One ox died on the farm Ilton, Shamva, three days after the second vaccination.

In a consignment of bulls from the Union one animal was found dead in the truck on arrival and cause determined as anthrax.

QUARTER-EVIL.

The following mortality in cattle was reported:—Belingwe, 36; Plumtree, 11; Umzingwane, 13; West Nicholson, 2; Matobo, 12; Inyati, 4; Macheke, 3; Hartley, 1; Marandellas, 1; Victoria, 54; Melsetter, 18. The existence of this disease was reported from the Gwelo, Umvuma and Charter districts, but no mortality statistics were available.

GALL-SICKNESS AND REDWATER.

These affections were prevalent in various districts.

SWEATING SICKNESS OF CALVES.

This disease has been much more prevalent than in any previous season, and a considerable mortality was reported from the Salisbury and Bulawayo veterinary districts.

MYIASIS OF CATTLE (SCREW-WORM).

The incidence of this affection was much less than during the corresponding months of previous years since its first appearance.

HORSE-SICKNESS.

Three horses died in Victoria district and three in Charter district.

IMPORTATIONS.

From the United Kingdom:—Bull, 1; cow, 1. From Union of South Africa:—Bulls, 12; cows, 10; horses, 12; mules, 58; donkeys, 77; sheep, 1,756; goats, 356.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, *via* Bulawayo, 359; *via* Liebig's Drift, 23; horse, 1. To Northern Rhodesia:—Horses, 4. To Belgian Congo:—Pigs, 28; sheep, 150. To Portuguese East Africa:—Cows, 9; slaughter oxen, 103; horses, 2; donkey, 1; goats, 34; sheep, 131.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Tobacco Statistics.

The Statistician regrets to state that an error occurred in the return of Virginia tobacco produced in the Lomagundi district during the season 1919-20, and published in the statistics of crops in the February number of this *Journal*. The return shows 9,100 lbs. from 67 acres, whereas the yield was 29,487 lbs. from 67 acres.

Farming Calendar.

April.

BEE-KEEPING.

Where numbers of the bee-louse are seen attaching themselves to the legs of bees and also among the quilts which cover the frames, this pest can be controlled by crushing them with the finger. In the cooler districts, crates that are partially filled with honey should be removed, and into the lift which they occupied plenty of warm clothing should be snugly packed.

CITRUS FRUITS.

During the early part of this month autumn budding can still be performed if sap is still up; in fact, if the season is late this operation is better done a little late than early, as in the event of late rains occurring, followed by a warm spell, the buds are liable to start growing, but are soon checked, the result of which is usually a stunted tree. Water by irrigation should be supplied to bearing orchards, unless unusual soaking rains have fallen late in season, followed by thorough cultivation and hoeing around trees. Continual watch must still be maintained for fruit-eating and codling moths. Spraying or fumigating against insect or other pests should not be neglected. Some early varieties may be expected to be ripening towards the end of this month.

CROPS.

The rains are practically over by this month, and the harvesting of early crops, such as buckwheat, linseed, teff grass and manna, will commence. The silo pit should be got ready, and the making of ensilage should be undertaken during this month. The cutting of veld hay for feeding should be completed by the end of the month. The mower, however, should be kept going, and the later cuttings should be utilised for litter in the kraals. All lands that are available should be ploughed. The preparation of vleis for winter crops should be continued, and late varieties such as Algerian oats should be sown this month; also barley for an early green crop.

DAIRY.

The milking kraal at this season of the year is generally far from clean, on account of the rain. By cows getting covered in mud from the kraal, and the mud drying and subsequently being rubbed off during the process of milking, the milk becomes highly contaminated with numerous species of bacteria. These bacteria, or germs, are the cause of nearly all the trouble in butter and cheese making which arises at this period of the year, i.e., during the wet season. To prevent the same, cows should be milked in a dry place, and free from dust. If the udders are found to be dirty just previous to milking, then the milker should clean the affected parts, as the udder, flanks, etc., with a cloth which has been wrung out in clean cold water—the udder should not be washed. The milker's hands should also be washed after each cow is milked. This all spells labour to certain people, but means all the difference between the production of first grade cream and third grade, or a saleable cheese and a non-saleable cheese. In the cheese-curing room, dampness is often prevalent during the wet season, with the result that the cheeses are often covered with green and white mould. This cannot altogether be prevented unless a properly constructed

room is available, therefore wipe each cheese with a cloth every day, and the shelves should be scrubbed once a week with hot water to which a handful of washing soda has been added, and when dry should again be washed with water to which has been added a few crystals of permanganate of potash. The cheeses may also be wiped with a cloth dipped in the same water.

DECIDUOUS FRUITS.

Orders should be given to the nurseryman for trees required in August, September or October. Trees will be lifted in August, and may with advantage be kept in cool storage till required.

ENTOMOLOGICAL.

Maize.—"Earworms" are sometimes troublesome in the tassels and ends of the cobs, but this pest cannot be directly attacked. Caterpillars may attack the crop, on account of their food being suddenly destroyed by late cultivation after the weeds have been allowed to get too far ahead.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt.

Potatoes.—Should be systematically cultivated and hilled, to keep tuber moth from tubers.

Cabbage Family.—Plants of this family are liable to suffer severely from cabbage louse and *Bagrada* bug.

Beans and Cowpeas.—Insect attack on these plants is but little obvious during April.

Dhal.—Suffers much from blister beetles destroying the blossom during April. Hand picking is the only remedy.

Citrus Trees.—Collect and destroy infested fruit, to keep down citrus codling.

FLOWER GARDEN.

Sow sweet peas. Hardy annuals, such as candytuft, cornflower, *eschscholtzia*, *gypsophilla*, larkspur, *mignonette*, poppy, etc., may be sown in the open ground, and should not be transplanted. Perennials may be sown in boxes.

FORESTRY.

If any seed has been sown during the previous month the resulting seedlings should be pricked out into tins.

Young trees planted during the season should be looked over, and where double leaders have developed reduce to single stems. Any abnormal branches should be shortened. The same remark applies to trees planted during the previous season. The object sought to be attained is well grown trees of single stems free from heavy branches.

Operations for protecting woods from fire should be put in hand.

Breaking up of new land should be continued where further tree planting operations are contemplated.

POULTRY.

The rainy season is now practically over, and the supply of eggs will begin to approach the demand, not because *per se* the rain has ceased, but because the fowls cannot get wet and will be able to exist under more comfortable and favourable conditions.

The first chicks of the breeding season should now be out. Keep them healthy and growing, and they will be filling the egg basket next September or October. Those of the heavy and dual purpose breeds will supply broody hens when they are so much wanted at the beginning of next breeding season. Late hatched chicks never make good birds; they never lay till the following spring, when any old bird will lay; nor can they be expected to

become broody when setting hens are most valuable. All the young cockerels of last season's breeding should now have been either killed or sold; only those that are being bred from this season should be present. There has been a good demand for breeding stock, especially for hens and pullets, and good ones are now almost unobtainable. Next year one can confidently guarantee that the demand will be even greater; therefore the poultry keeper who hatches early and properly will have the stock for sale (but it must be good) and will benefit thereby.

Foodstuffs are expensive and give promise of continuing to be so. All poultry keepers would do well, therefore, before it is too late, to grow what they can, and to store for future use anything in the way of grain, but especially beans, peas, monkey nuts, mealies, sunflower and munga. The same applies to green foods, such as sunflower leaves, dhal, Napier fodder; in fact, anything that will dry quickly in the sun after being picked green. When dry, break up, sift and store in sacks and use when green food becomes scarce in the same way as lucerne meal is. The repeated complaint of poultry keepers during the dry season is their inability to obtain green food, and without this eggs and health cannot be looked for. The remedy is to gather and store it before it withers and becomes scarce or practically unobtainable.

As the dry weather approaches, watch for insects. Dip your birds periodically, and take precautions against sand fleas by greasing the heads of your birds frequently, and watering the floors of the houses and ground around them occasionally with a solution of some non-poisonous disinfectant and water.

STOCK.

Cattle.—Cattle on the ranch should require little attention beyond dipping. Bulls should be kept out of the herd if January calves are not desired, and care should be taken to see that they are thriving and gaining condition for service again next month.

Towards the end of the month dairy cattle in most districts will begin to require some supplementary food. A small ration of maize if the price permits will be advantageous, but in any case they will repay some extra succulence such as Napier fodder, green maize stalks or ensilage, if any of the latter is left over from the previous year. The same applies to calves; and indeed supplementary food should be given to all dairy stock the moment they show signs of falling off in condition. An early start tends to lessen the total amount of food required during the winter. All preparations for making ensilage should be completed by the end of the month. Any hay-making left undone should be attended to without delay. Attention should be given to water supplies for winter, and arrangements made to prevent water holes, etc., being trodden in as the supply shortens.

Sheep.—If grass seeds are troublesome, an area should be mown for grazing. The vleis should be avoided. It will probably be wise to keep the rams out of the flock for another month, so that lambs will not appear before October, when one may reasonably expect some grazing. This, however, is a matter for individual judgment in accordance with the nature of one's own farm or district.

TOBACCO.

Curing will be continued during the month. Care must be taken to yellow the leaf well before drying out. All bales or bulks of cured tobacco should be carefully examined weekly to ascertain the keeping condition of the leaf. Seed heads should be removed when the pods are brown and stored in a cool dry room. Lands should be ploughed and harrowed as soon as all tobacco has been removed.

VEGETABLE GARDEN.

Potatoes require ridging and tomatoes staking and tying up. Potatoes which mature after the rains may generally remain in the soil and be lifted

as required. Vegetables planted out for winter crops should be well and continuously cultivated, which will bring them along quicker, with less watering. Beans and peas should be staked and tied. Beans, carrots, cabbage, cauliflower, peas, turnip, spinach, beet and radish should be sown for late winter crops.

VETERINARY.

Horse-sickness will be prevalent this month, as will blue tongue in sheep. The first symptom in the latter is laminitis, the second a protruding blue tongue.

WEATHER.

Along the higher ridges of the country we may still look for an inch of rain, more or less, during the month, though little, if any, can be expected in the Zambesi and Limpopo valleys and all low-lying parts of the country. As often as not, however, April is a dry month. In past years it has occasionally happened that early frosts have been recorded which put an end to the tobacco harvest, and may kill tender vegetables and flowers; but, as a rule, no such calamity need yet be expected, and if at all, only in frosty hollows.

May.

BEE-KEEPING.

The scarce supply of nectar, due to conditions of drought, will be responsible for a deficiency of stores. Where this is noticed, steps must at once be taken to supply the bees with artificial food in the shape of syrup. A feeder must be placed above the frames inside the hive. Never feed bees outside, as it promotes robbing.

CITRUS FRUITS.

Continue irrigating bearing orchards up to within three weeks of picking fruit, followed by cultivation and hand hoeing. The same remarks as in April apply concerning insect pests, etc. Washington Navel oranges will be ripening this month, and possibly some early ripening seedlings.

CROPS.

Some maize should be ready for cutting and stooking. Ploughing should be continued on all available lands. Winter crops in vleis, such as Early Gluyas and other wheats, oats and barley, should all be sown not later than this month. Napier fodder may still be cut for ensilage, and this will give time for a considerable after-growth, which can serve as winter pasture.

DAIRY.

(See April.)

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse and Bagrada bug during May. For the former, spray with soap and tobacco wash, which may help if the plants are not too big.

Dhal.—Blister beetles are still injurious to the blossom of the crop, and should be regularly collected and destroyed.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter.

FLOWER GARDEN.

Sow *in situ* cornflower, larkspur, mignonette, poppy; sweet peas may also be planted.

FORESTRY.

Continue pricking out seedlings into tins. Deciduous trees which are propagated by means of cuttings should be taken in hand.

See that the fire lines are in order, and in the case of woods which have formed canopy remove inflammable material below the edge trees.

Place orders for any trees proposed to be planted during the ensuing season, so that nurserymen may make provision.

POULTRY.

The weather will now be getting cooler and the nights especially colder, and this must not be forgotten. The chicks must on no account be allowed to get chilled. Once a chick, especially in the early stages, is chilled its growth for the time being is checked and it frequently dies. It is so simple to put a little more chaff or cut hay on the floor of the brooder or coop, to put a sack over it, or, if the night promises to be extra cold, to take them into a comfortable shed. A little extra care of this kind means the difference between a brood of good healthy chicks and one of stunted weakly ones. On the other hand beware of over-crowding. More chicks are ruined by this than all the insect pests and diseases combined. One *so often* sees the after effects of this in poor weakly stock. Remember that the brooder which will hold comfortably 50 chicks when just hatched is far too small for that number in a fortnight, and half should be transferred to another of the same size and so on till the chicks are large enough to go into open-fronted coops.

Never rear chicks in the same brooders or coops as used in the preceding year unless they have been properly cleaned and disinfected. This should always be done at the end of each season, at the beginning of the next and *kept* clean all through the rearing season. Further, *never* run the chicks on the same ground as that used for chicks the previous season without in the meantime having grown a crop on it to take out all the taint and septic matter. On the whole it is best and safest to move the chicks on to new rearing ground each season.

Don't forget that when rearing chicks, insects, meat food of some sort or better still thick separated milk, chopped onion tops or onions, hard sharp grit, *not* sand, wood charcoal and clean water are absolutely essential; that dry meal is preferable to wet mash and that constant scratching for grain is all important.

As the cockerels begin to shew their sex, pick out the best according to the instructions given in the *Agricultural Journal* for October, 1913, or Bulletin 299. Put them on one side away from and if possible out of sight of the pullets, and get rid of the remainder.

Remember that chickens and fowls are creatures of habit and can be trained. If you don't wish your fowls to be always around the house or on the verandah, they must not be allowed to remain near it too long. It is as well, after they have grown their first chicken feathers, to gradually as they grow older move them farther away. One or two *good* dogs and traps properly set will keep the ground vermin in check, and the gun is the best remedy for hawks.

STOCK.

Cattle.—Ranching cattle may still be expected to be in good condition. In most districts it will be wise to conserve hay, maize stover, ensilage and a supply of any other cheap feed as a provision against possible late rains in the spring, and to enable one to maintain the younger or very old stock should occasion arise. (See Bulletin 331.) By the middle of this month dairy cattle will require more serious attention in the matter of feed, and

in this connection we would refer our readers to Bulletin No. 345. Grass should be cut for bedding and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies and care taken that they are clean and sufficient.

Sheep.—The vleis having dried, sheep may be allowed into the lower lying veld. If the rams are put in now, lambs will arrive in October, which is usually a good month to arrange for. Those who favour winter lambs, and have ewes lambing now will find a few handfuls of maize, together with chopped maize stalks or any other kind of available roughage or green stuff, a great help to the ewes in providing milk. (See Bulletin 287.)

TOBACCO.

Curing should be finished as early in the month as possible, to prevent loss from frost. The bales or bulks of cured tobacco should be examined weekly until sent to the warehouse. Tobacco seed should be shelled as soon as the seed pods are dry, and the seed carefully labelled and stored. All tobacco lands should be ploughed and harrowed.

VEGETABLE GARDEN.

Sow broad beans, peas, lettuce, spinach, parsnips, carrots, radish and beet. Constant cultivation is necessary.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

The dry season should have now set in, though averages of from a quarter of an inch to three-quarters are indicated in the official reports. Ground frosts at night have been recorded, but are very unusual.

Weather Report.

JANUARY AND FEBRUARY, 1921.

The barometric pressure was slightly below normal during January and February. The mean temperature during January was 1.5 deg. above the normal in Mashonaland. The day temperatures were 2 deg. above normal and the night temperatures 1 deg. above normal. In Matabeleland the mean temperature during January was 1 deg. below

the normal, both day and night temperatures being 1 deg. below normal. The mean temperature during February was normal in Mashonaland. In Matabeleland the mean temperature during February was 0.5 deg. below normal, the day temperature being 1 deg. below normal, and the night temperature normal.

At the end of December, 1920, the rainfall for the season was below the average in practically all the districts in the country. In Mashonaland there were heavy general rains during the first two weeks of January, but the latter half of the month was generally dry. Hartley, Mrewa and Mtoko are the only districts in Mashonaland in which the total January fall was above the average. In Charter, Darwin, Inyanga, Lomagundi, Salisbury and Umtali districts the January fall was less than half an inch below normal. The discrepancy was most marked in the south-eastern districts of Melsetter, Ndaunga, Chibi, where the January fall was from two to five inches below the average.

During February the rainfall was above the average in the western half of Mashonaland, but in all the eastern districts the fall was still below the average during the month. The discrepancy is most marked in the extreme eastern districts of Inyanga, Umtali and Melsetter, where it amounts to three to four inches below the average. This discrepancy becomes less as we progress westwards, and becomes an excess on a line west of Makoni, Gutu, and the Victoria districts. The seasonal total to the end of February is below the average in all districts in Mashonaland with the exception of Hartley district, where the seasonal fall is 1.50 inches above the normal.

In Matabeleland the January rains were more nearly normal. They were above the average in the districts of Bubi, Bulalima, Bulawayo, Gwelo and Insiza, the excess varying from $\frac{1}{2}$ inch in the case of Gwelo to $2\frac{1}{2}$ inches in the Bulawayo district. In Umzingwane district the January fall was normal. In all other districts the January fall was below the normal, the deficiency being most marked in Belingwe district, where it amounted to $4\frac{1}{4}$ inches, and in Gwanda district, where it amounted to 2 inches. The February fall was above the average in all districts in Matabeleland with the exception of Selukwe, where the deficiency amounted to 2 inches. It was normal in Gwanda, Belingwe and Wankie districts. The excess was greatest in Sebungwe district, where it amounted to 5 inches; in other districts it varied between 1 to 3 inches. In Matabeleland the seasonal total to the end of February is above the average in the districts of Bubi, Bulalima, Bulawayo, Insiza, Nyamandhlovu and Sebungwe, the excess amounting to from 2 to 4 inches. In all other districts the seasonal total is below the average. The deficit amounted to 6 inches in Belingwe district, 9 inches in Selukwe district and 4 inches in Gwanda district. In other districts the discrepancy amounts to between 1 to 3 inches. During the first two weeks of March heavy rains well above the average were general throughout the country, causing the fall to date to be almost normal in most districts, with the exception of those along the eastern border.

The following table shows a comparison between rainfall in January and February, 1921, and normal fall in those months, and also seasonal rainfall, 1920-21 to end of February, and average to that date.

MASHONALAND.

District.	Rainfall January normal.	Rainfall January 1921.	Rainfall February normal.	Rainfall February 1921.	Normal total end Feb.	Total end Feb. 1921.
Charter ...	7.44	7.39	6.35	8.33	24.77	22.16
Chibi ...	7.20	2.71	4.27	4.02	19.17	13.31
Chilimanzi ...	8.07	7.24	4.73	5.05	23.27	18.20
Darwin ...	8.46	8.18	6.85	6.87	25.79	21.65
Gutu ...	7.45	6.39	7.09	4.21	25.96	19.12
Hartley ...	7.95	9.40	7.39	12.20	26.91	28.43
Inyanga ...	10.13	10.04	8.93	4.73	30.57	25.50
Lomagundi ...	7.73	7.25	7.62	8.66	26.69	23.48
Makoni ...	9.25	7.83	6.96	6.31	28.22	22.00
Marandellas ...	8.95	7.58	7.63	9.99	28.88	25.03
Mazoe ...	9.55	7.30	7.46	9.53	28.39	24.50
Melsetter ...	11.31	9.47	9.48	6.63	38.12	28.90
Mrewa ...	8.61	8.63	8.52	11.63	29.11	27.99
Mtoko ...	8.82	9.23	5.69	6.95	24.95	23.20
Ndanga ...	13.44	6.63	7.49	4.83	37.75	21.31
Sali-bury ...	7.90	7.69	7.25	9.09	27.03	23.46
Umtali ...	7.69	7.36	6.30	3.00	25.29	17.73
Vitoria ...	6.84	5.36	5.48	4.25	23.10	19.66

MATABELELAND.

District.	Rainfall January normal.	Rainfall January 1921.	Rainfall February normal.	Rainfall February 1921.	February seasonal normal.	Seasonal 1921 February
Belingwe ..	8.29	3.97	5.72	5.75	22.57	16.72
Bubi ...	7.43	9.34	4.59	6.71	20.53	24.40
Bulalima ...	6.62	8.07	4.02	7.14	19.72	24.12
Bulawayo ...	5.95	8.39	3.76	4.94	19.58	21.03
Gwanda ...	5.90	3.87	3.35	3.29	17.97	13.81
Gwelo ...	6.54	6.99	5.20	7.47	22.76	21.45
Insiza ...	5.64	6.95	4.81	6.72	19.89	22.13
Matobo ...	8.00	7.29	5.41	6.17	22.67	19.47
Nyamandhlovu ..	7.79	5.84	3.82	6.90	20.03	20.94
Selukwe ...	8.95	8.06	10.13	8.20	32.36	23.58
Sebungwe ...	8.67	7.06	6.58	11.71	26.02	30.68
Umzingwane ...	7.37	7.30	4.75	5.72	20.25	17.69
Wankie ..	5.69	5.48	5.24	5.19	20.16	17.94

Weather Bureau.

RAINFALL.

STATION.	1921.		Seasonal to Date.
	January.	February.	
MASHONALAND—			
Charter—			
Buhera	5.33	6.41	16.18
Bushy Park	7.63	8.41	22.91
Enkeldoorn Gaol	9.75	5.46	21.95
Marshbrook	5.84	13.97	26.64
Range	10.47	7.26	24.23
Riversdale	6.52	8.47	20.28
Umniati	7.40	7.80	21.52
Vrede	6.15	8.90	23.61
Chibi—			
Chibi	3.99	4.02	13.31
Mwenzi	1.50	6.13	11.91
Chilimanzi—			
Central Estates	6.32	10.37	22.67
Chilimanzi	6.81	2.17	13.47
Driefontein	4.97	2.06	11.26
Grootfontein	6.88	2.81	17.02
Felixburg	7.50	4.28	18.86
Induna Farm	8.86	7.24	20.14
Orton's Drift	10.15	6.21	21.77
Wylde Grove	6.40	5.28	19.26
Darwin—			
Mount Darwin	8.18	6.87	21.65
Gutu—			
Alheit Mission	6.27	2.51	17.37
Eagle's Nest Rancho	6.37	—	—
Gutu	6.04	5.09	21.51
M'vimvi Rancho	8.60	4.71	17.52
Glenary	6.02	4.64	19.55
Tel-el-Kebir	6.37	2.88	13.74
Hartley—			
Ardgowan	6.58	16.09	29.74
Beatrice (B.S.A.P.)	11.40	13.45	32.37
Carnock Farm	8.51	6.89	24.17
Cringelford	10.87	14.08	34.15
Cromdale	9.65	12.35	24.29
Elvington	12.60	8.55	26.29
Gatooma	8.88	14.05	28.61
Gatooma (Railway)	5.50	10.70	24.84
Gowerlands	8.12	10.02	24.82
Hartley Gaol	7.86	13.40	28.77
Hopewell	10.60	11.75	29.72

RAINFALL—(Continued).

STATION	1921.		Seasonal to Date.
	January.	February.	
MASHONALAND—(Continued)			
Hartley—continued			
Jeninstown	10·23	13·31	38·68
Ranwick	5·26	16·58	31·35
Pollockshields	10·45	10·31	24·08
Spitzkop	8·29	11·51	24·60
Umsweswe	16·10	—	—
Inyanga—			
Inyanga	11·33	4·17	25·91
St. Trias' Hill	8·56	4·73	22·66
York Farm	10·22	4·54	27·92
Lomagundi—			
Argyle	9·32	7·61	25·51
Duxbury Farm	7·29	6·67	20·10
Gambuli (Mukore)	6·89	9·77	24·68
Impingi	5·71	11·29	24·44
Lone Cow Estate	9·27	12·47	28·74
Mafoota	5·05	7·95	18·70
Maningwa	8·46	6·04	22·85
Mpandaguta	6·59	12·54	25·65
Mukwe River Ranche	6·95	8·11	22·69
M'Vaami Farm	7·51	9·06	27·38
Palm Tree Farm	6·82	4·68	21·17
Nyaroro	8·07	6·02	18·17
Sinoia	5·72	6·95	19·42
Sipolilo	8·47	8·36	20·23
Talfourd	6·09	7·13	22·41
Mrindogone	7·78	13·86	33·56
Makoni—			
Carlow Farm	6·64	—	—
Chimbi Source (Chitora)	7·40	7·47	20·42
Craigendoran	5·16	2·67	15·27
Eagle's Nest Ranche	9·04	8·83	22·74
Forest Hill	8·18	3·14	19·81
Gorubi Springs	9·54	3·32	19·93
Mona	5·74	9·69	21·55
Monte Cassino Mission	7·90	8·41	23·08
Springs	12·69	6·87	31·70
Wensleydale	8·05	6·94	23·96
Marandellas—			
Bonongwe	4·95	13·09	23·53
Huish Estate	5·11	10·51	22·24
Longlands	5·07	11·38	29·35
Land Settlement Farm	8·41	—	—
Lendy Estates	11·29	13·64	31·45
Marandellas	6·82	9·39	22·64
Nelson	8·22	6·35	19·74
Tweedjan	11·73	5·40	25·67
Delta	8·32	10·62	25·92
Igudu	3·42	10·04	21·92

RAINFALL (*Continued*).

STATION	1921.		Seasonal to Date.
	January.	February.	
.MASHONALAND—(Continued)			
Mazoe—			
Avonduur	5.95	0.29	20.62
Benridge	6.57	17.75	19.99
Bindura	8.35	8.19	22.11
Bindura (Railway)	10.32	9.05	25.14
Ceres	6.66	9.12	20.55
Chipoli	7.95	6.61	19.26
Citrus Estate	5.30	2.75	26.21
Craigengower	5.59	19.17	20.34
Kilmer	6.63	8.79	21.42
Kingston	10.41	0.61	26.73
Marston Farm	7.39	17.59	18.81
Mazoe	5.55	12.84	25.11
Mazoe Dam (Centre)	4.86	11.18	24.68
Omeath	7.29	7.45	19.24
Ruia	10.16	9.59	25.45
Ruoko Ranche	8.95	10.22	24.91
Rustington	6.81	4.56	16.82
Shamva	7.37	7.23	17.59
Stanley Kop	4.11	10.88	20.20
Sunnyside	5.80	10.76	24.98
Teign	5.16	10.27	20.82
Usk	7.07	12.91	26.33
Virginia	6.10	10.39	21.89
Woodlands Farm	6.56	10.66	24.28
Zombi Farm	8.95	11.50	30.20
Melsetter—			
Brackenburgh	14.12	5.09	34.40
Chibazana	9.06	—	—
Chitora	4.98	6.32	21.59
Helvetia	12.42	8.15	34.55
Chipinga	5.04	6.36	19.87
Melsetter	7.87	6.52	26.56
Mount Selinda	10.99	6.07	32.42
Tom's Hope	9.04	7.50	28.40
Vermont	11.72	7.04	33.33
Mrewa—			
Glen Somerset	7.10	11.46	26.09
Mrewa	7.50	12.64	25.80
Selous Nek	11.30	10.78	32.07
Mtoko—			
Makaha	7.21	6.88	22.58
Mtoko	11.25	7.02	23.82
Ndanga—			
Bikita	8.53	6.26	31.65
Doornfontein	4.90	5.22	18.79
Marah Ranche	7.05	3.04	13.06
Ndanga	6.03	4.81	21.70

RAINFALL (*Continued*).

STATION	1921.		Seasonal to Date.
	January.	February.	
ASHONALAND—(Continued)			
Salisbury—			
Avondale	7.51	10.72	26.24
Borrowdale (Hatchliffe)	9.27	12.06	26.85
Botanical Experiment Station	4.87	10.24	24.16
Bromley	5.68	10.58	20.09
Cleveland Reservoir	12.68	8.22	27.29
Forest Nursery	6.85	8.50	20.10
Glenara	8.12	8.37	21.25
Goromonzi	9.92	7.95	24.08
Gwebi	5.09	7.05	20.90
Hillside	6.43	7.61	20.53
Lochinvar	9.71	8.74	27.40
Lilfordia	8.53	9.48	22.38
Meadows (The)	11.11	8.30	25.80
Salisbury (Railway)	6.34	9.68	23.75
Sebastopol	5.94	7.10	18.12
Selby	5.35	8.23	20.72
Stapleford	9.15	12.01	30.10
Tisbury	8.39	8.81	22.29
Vainona	7.09	9.13	23.69
Umtali—			
Hoboken	8.79	16.20	35.64
Gilmerton	6.22	1.23	15.48
Mutumbara Mission	1.52	2.41	11.81
Odzani River (Power Station)	9.39	3.50	22.91
Odzi Drift	7.56	2.56	15.77
Premier Estate	7.00	2.39	17.36
Gaol	4.71	2.44	14.66
Reservoir	8.18	4.41	22.11
Sarum	7.03	4.64	20.05
Stapleford	13.90	5.37	35.05
Stralsund	8.46	2.12	22.15
Utopia	5.56	1.94	—
Victoria—			
Brucehame	4.88	5.05	19.39
Clipsham	5.22	4.87	20.49
Cavan (Empress Mine)	4.73	5.55	19.21
Gokomere	7.69	4.11	19.66
Stanmore	3.77	1.31	12.46
Histonhurst	5.09	3.57	17.53
Jichidza Mission	8.40	4.02	27.24
Makorsi River Rancho	3.76	5.85	22.15
Morgenster Mission	6.31	6.86	26.69
Riverdene North	4.14	1.99	17.12
Silver Oaks	4.67	2.92	15.77
Summerton	6.13	3.22	16.10
Makahori Farm	5.59	2.90	14.57
ATABELELAND :			
Belingwe—			
Bubje Ranch	3.34	5.59	12.30
Bickwell	5.08	4.92	20.12

RAINFALL (*Continued.*)

STATION.	1921.		Seasonal to Date.	
	January.	February.		
MATABELELAND—(Continued)				
Belingwe—continued				
Belingwe	...	5·07	9·44	23·25
Tamba	...	4·93	3·04	11·23
Wedza	...	4·31	8·40	16·58
Sovele	...	1·11	5·80	9·09
Bubi—				
Imbesu Kraal	...	9·40	6·80	22·97
Shangani Estates	...	10·38	6·62	25·83
Bulalima-Mangwe—				
Empandeni	...	8·61	5·58	21·52
Garth	...	11·68	8·23	28·69
Kalaka	...	3·53	8·74	21·30
Retreat	...	8·73	4·82	—
Riverbank Farm	...	6·02	8·91	23·36
Solusi Mission	...	9·19	5·38	24·80
Tjankwa	...	10·01	8·11	25·15
Tjompantie	...	8·64	7·34	24·05
Bulawayo—				
Keendale	...	9·62	5·13	21·50
Lower Rangemore	...	7·43	3·89	20·13
Observatory	...	7·41	5·95	21·03
Paddy's Valley	...	9·94	5·59	19·37
Umgusa	...	11·38	4·16	23·12
Gwanda—				
Gwan la (Gaol)	...	7·23	4·60	18·61
Insindi (only from December)	...	7·10	4·56	15·00
Lamulas	...	0·63	2·97	8·04
Langalanga	...	1·31	2·05	6·84
Mahalali	...	2·12	4·79	9·53
Mapande	...	2·55	2·43	7·99
Mrandas	...	3·64	3·21	9·08
Mtshabezi Mission	...	5·69	2·36	12·23
Tuli	...	2·39	1·65	9·39
Gwelo—				
Dawn	...	7·93	8·05	22·38
Cross Roads Farm	...	8·46	6·47	19·55
Globe and Phoenix Mine	...	5·06	9·23	22·08
Gwelo (Gaol)	...	5·63	10·57	19·90
Lover's Walk	...	11·19	6·97	25·17
Oaklands	...	7·82	9·42	24·36
Partridge Farm	...	7·29	8·39	21·88
Rhodesdale Rancho	...	5·99	5·88	18·27
Riversdale	...	5·47	6·71	23·42
Somerset Estate	...	5·72	8·67	21·42
Sikombela Farm	...	7·49	9·26	26·64
Sheep Run Farm	...	6·08	5·44	17·30
Woodendhove	...	6·77	4·78	16·48
Insiza—				
Albany	...	7·62	6·06	20·05
De Beers' Old Homestead	...	4·35	—	—
Filabusi	...	7·35	5·46	22·14

RAINFALL (*Continued*).

STATION.	1921.		Seasonal to Date.
	January.	February.	
MATABELELAND—(Continued)			
Insiza—continued			
Fort Rixon	7.99	8.66	25.93
Infiningwe	5.85	6.46	22.03
Inyezi Farm	6.02	3.42	15.01
Orangedale	7.01	8.69	24.39
Rodebeuvel	8.51	6.84	25.42
Thornville	7.89	8.14	22.08
Matobo—			
Holly's Hope	4.10	3.89	11.44
Matopo Mission	8.04	6.40	22.19
Rhodes Matopo Park ...	9.72	8.23	24.78
Nyamandhlovu—			
Edwaleni	7.20	4.55	18.09
Mpondemi	5.80	5.94	19.35
Naseby Farm	5.78	10.20	25.39
Sebungwe—			
Gokwe	9.97	11.71	30.66
Selukwe—			
Hillingdon	5.39	8.64	16.99
Selukwe (Railway)	12.34	12.68	33.52
Aberfoyle Ranche	5.46	6.65	21.55
Rio	9.06	4.84	22.28
Umzingwane—			
Essexvale	8.04	4.37	19.48
Springs Farm	5.59	7.07	15.90
Wankie—			
Guyo	5.75	2.93	13.94
Lynwood Estate	8.18	8.43	25.02
Matetsi (Railway)	3.66	3.73	14.87
Ngamo (Railway)	5.87	6.67	19.96
Wankie Hospital	5.82	3.56	17.58
Waterford	3.60	5.84	16.28

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1921			
			April	May	June	
Banket Junction ..	Banket Junction	G. Anderson	2	7	4	
Bindura ..	Bindura	G. Askew	9	14	11	
Bromley ..	Bromley	C. R. Beary	7	9	2	
Charter—Agezi ..	Charter's Hall, Beatrice	W. Krienke	28	26	29	
Central ..	Unyama ..	M. W. Graham	..	..	24	
Parwin ..	Aravalia Farm and Mt. Parwin Store	..	..	..	..	
Eastern Border (South Melssett) ..	alternately ..	J. W. Giles	10	8	12	
Eastern Districts ..	East Riverwood	J. W. Scott	8	12	10	
Enterprise ..	Good Hope School	J. W. Scott	9	14	11	
Felixburg—Guta ..	Arcturus Hotel	J. W. Scott	6	11	8	
Figtree Branch, R. L. and F.A. ..	Noelale Farm and Felixburg	W. K. Hudson	9	..	11	
Galiza ..	Figtree Hotel	E. Laing	23	28	25	
Gatoona ..	Unyama Drift	A. Kelsey-Harvey	21	19	23	
Gazaland ..	Gatoona	E. Seale	..	..	..	
Greystone ..	Chipinga	W. Wood	No	fixed	dates	
Harare ..	Various farm houses, Shuangwi	M. Kerr	..	..	..	
Headlands ..	Royal Hotel, Gwanda	A. C. Edmondstone	16	21	18	
Hendricks ..	Harare	J. de L. Niumo	23	28	25	
Hunter's Road Farmers and Stockowners ..	Hunter's Road	R. Greaves	..	..	..	
Inaiza—Shananguni ..	Hunter's Road Siding	R. Greaves	..	..	..	
Inyanga ..	Shananguni	R. Greaves	16	14	11	
Inyazura ..	Farm, Juliusdale	R. J. Hacking	9	14	18	
Lalapansi ..	Inyazura	R. J. Hacking	19	17	21	
Lomagundi ..	Lalapansi	P. H. Bells	14	12	9	
Macheke ..	Sinola	R. E. Courthope Giles	23	21	18	
Makwiro ..	Macheke	J. G. Clarkson	..	..	..	
Makwiro ..	Makwiro	W. L. McLennan	15	fixed	dates	
Makoni ..	Mr. Wiggall's Farm, Makoni South	D. M. Syme	27	20	17	
Marandellas, Northern ..	Marandellas	J. G. Monckton	27	20	29	
Marandellas, Southern ..	Marandellas	W. R. Tapsen	14	14	11	
Masionaland ..	Marandellas Farmers' Hall	A. E. Stanley	2	7	4	
Matopo Branch, R. L. and F.A. ..	Marandellas	A. E. Stanley	6	7	4	
Mazoe ..	Commercial Hotel, Salisbury	Civil Allen	1	6	3	
Mazoe Central ..	Various farm houses	S. Gillespie	No	fixed	dates	
Melssett ..	Glendale Siding	Mrs. Voxall West	13	11	8	
Melssett (North) ..	Mazoe	P. D. Peacey	8	13	10	
Melssett ..	Melssett	J. Harvie	..	7	..	
Melssett ..	Crookley	R. Wadehouse	..	4	..	
Melssett ..	Royal Hotel, Gwelo	M. Tunziger	..	10	14	
Northern and Stockowners ..	Marandellas	W. Tunziger	12	..	..	
Norton and District ..	Norton Store	W. Tunziger	..	..	..	
Que Que ..	Que Que	E. J. Hopkins	16	21	18	
Rhodesian Landowners and Farmers ..	Library Buildings, Bulawayo	E. J. Hopkins	16	21	18	
Selous ..	Various farms	E. L. Sompset	28	26	20	
Shamva ..	Selukwe	E. E. Sompset	16	fixed	dates	
Unyukwe ..	Shamva	Capt. N. Stanley Shiland	..	..	..	
Unyukwe ..	Various ranches	Capt. N. Stanley Shiland	21	19	16	

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

Co-operative Experiments

WINTER CEREALS.

With a view to encouraging the growing of winter cereals, both under irrigation and on vleis, and also of introducing new varieties which may prove superior to those at present grown, it is hoped that the following varieties will be available for free distribution from the beginning of March onwards:—

Wheat.—Early Gluyas, Early Australian, American No. 8, Union No. 17, Lalkasar Wali and Zwart Aar.

Barley.—Smyrna—malting type.

Oats.—Algerian and Boer.

Rye.—Cape Early.

At the date of going to press it is not certain that all the above varieties will be obtainable. In any case, stocks are limited, and not more than three kinds of seed can be sent to any one applicant.

All applications should be addressed to the *Chief Agriculturist and Botanist, Department of Agriculture, Salisbury*.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 106. Cultivation and Preparation of Ginger.
- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.

- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
- No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
- No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
- No. 334. Flue Curing Tobacco Barns and Packing House, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops, 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 307. Rainfall Statistics, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
 No. 146. Notes on Cattle Breeding, Part II., by R. C. Simmons.
 No. 165. Feeding and Care of Imported Cattle, by R. C. Simmons.
 No. 195. Some Notes on the Systematic Dipping of Stock, by C. R. Edmonds, Assistant Chief Veterinary Surgeon, and L. E. W. Bevan, Government Veterinary Bacteriologist, Southern Rhodesia.
 No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
 No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by R. C. Simmons.
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 No. 229. Breeding and Feeding of Pigs for Bacon Factory Purposes, by R. C. Simmons.
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 No. 336. Butchering and Flaying.
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 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
 No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
 ——— Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 184. Cream, its Separation, Handling and Sale to Butter Factories, by R. C. Simmons.
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 No. 243. Shedding for Milch Cows, by R. C. Simmons.
 No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 284. Establishment of Dairy Herd on Granite Veld, by R. C. Simmons.
 No. 308. Cream Cheese, by J. B. Fisher, N.D.D.
 No. 311. Gouda Cheese Making, by J. B. Fisher, N.D.D.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 82. Difficult Parturition of the Cow, by C. R. Edmonds, M.R.C.V.S., G.V.S.
 No. 95. Oestrus-ovis in Sheep, by Alec King.
 No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 No. 191. Scab or Scabies in Sheep and Goats. by Rowland Williams, M.R.C.V.S.
 No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
 No. 272. African Coast Fever: Schedule of Outbreaks to 1916, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
 No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
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 No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
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 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.

IRRIGATION.

- No. 64. Hints on Irrigation—Small Gravitation Schemes, by W. M. Watt.
 No. 186. Concrete and Reinforced Concrete, by E. Hardcastle, M.I.E.E.
 No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
 No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
 No. 217. Windbreaks and Hedges, by F. B. Willoughby.
 No. 234. Eucalypts suitable to Southern Rhodesia, and how to Grow them, by F. B. Willoughby.
 No. 236. Notes on Propagation by Means of Cuttings in Rhodesia, by F. B. Willoughby.
 No. 267. Trees for Farm and Ornamental Purposes, by W. E. Dowsett.
 No. 366. The Management of Woods, by J. S. Henkel.
 No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
 No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas. by R. W. Jack, F.E.S.
 No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.
 No. 265. Rose Culture, by N. L. Kaye Eddie.
 No. 296. Citrus Nursery Work, by A. G. Turner.
 No. 354. The Home Orchard, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
 No. 147. Root Gallworm, by R. W. Jack, F.E.S.
 No. 148. Darkling Beetle Grubs Injurious to Tobacco, by R. W. Jack, F.E.S.
 No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
 No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
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 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.
 No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
 No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
 No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
 No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
 No. 291. Cutworms, by Rupert W. Jack, F.E.S.
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.

POULTRY.

- No. 198. Poultry Keeping for the Rhodesian Farmer, by Frank Sheppard.
 No. 350. The Basis and Beginning of Poultry Keeping, by A. Little.
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 No. 371. Ducks, by A. Little.
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MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
 No. 129. How to Make Use of the "Fencing Ordinance, 1904," by N. H. Chataway.
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
 No. 254. Hints on Explosives, by W. M. Watt.
 No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
 No. 273. Enkeldoorn Produce Express Syndicate Rules.
 No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
 No. 283. Maize Foods for the Home.
 No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
 No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
 No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.

- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 Malarial Fever: How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
 Directory of Rhodesian Farmers and Ranchers.
 The Analyses of Agricultural Products, Soils, Water, etc.
 Lectures for Farmers.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 54 of 1921.]

[28th January, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water:—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Hugh Partridge	Guberie	Gwelo	Farm Partridge

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 87 of 1921.]

[11th February, 1921.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following applications have been made for authority to use water:—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
J. H. Bezuidenhout	Matchim-bere	Victoria	Farm Ballymore
A. G. Syfret ...	Umwindsi	Salisbury	Farm The Springs
C. C. Townsend ...	Mazoe	Mazoe	Farm Lowdale
Williams & Kilpin	Macheke	Marandellas	Farm Train
Rhodesia Railways, Limited	Khami	Bulawayo	For mechanical and industrial purposes and for generation of power.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 95 of 1921.]

[18th February, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
G. H. Gordon	Seedje	Loma-gundi	Farm Kashuo

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 136 of 1921.]

[11th March, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
A. W. R. Rademeyer	Burgwe	Ndanga	Burgwe

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 143 of 1921.]

[18th March, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1915, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water:—

Name of applicant	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Ainslie & Charlesworth	Tanda-fusi	Loma-gundi	Birkdale

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 73 of 1921.]

[11th February, 1921.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," and in terms of section 17 of Government Notice No. 21 of 1917, to declare the following area of infection and guard area:—

MELSETTER NATIVE DISTRICT.

Area of Infection.

The farm Quagga's Hock.

MELSETTER AND UMTALI NATIVE DISTRICTS.

Guard Area.

An area bounded by and including the farms Weltevreden, Camperdown, Cromer, Nyanyadzi, the Mutambara Reserve (excluding a strip of two miles along the Odzi River), Lisnacloon, Inyaruparu, Minyinga North and Tambara, and from the last-named farm by the Anglo-Portuguese boundary to the farm Weltevreden.

No. 120 of 1921.]

[4th March, 1921.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 180 of 1918, declaring the farms Lyndhurst, Porta and Riverside, in the district of Salisbury, an area infected with swine fever.

RHODESIA Agricultural Journal.

ISSUED BY

The Department of Agriculture,
SALISBURY, RHODESIA.

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The Journal is issued every alternate month.

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The right of approval of all advertisements by the Director of Agriculture is reserved, and his decision as to the acceptance or rejection is final.

An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words.

Memorandum on the Cattle Industry of Southern Rhodesia, 1921.

Preface.

As the outcome of public and private conversations a meeting of the utmost importance to the cattle industry of Southern Rhodesia took place at Bulawayo on the 20th November, 1920, when the following resolution was, after an interesting discussion, unanimously adopted:—

“That it is of urgent importance that comprehensive accurate information regarding the present position and immediate prospects of the cattle industry of Southern Rhodesia be compiled and made available to all interested, with a view to furnishing data upon which may be based proposals for the development of a meat industry by means of export and manufacture.”

This public meeting nominated a committee with power to add to its numbers to carry into effect the above resolution, and with Mr. St. C. B. Gwynn, the Chairman of the Cattle Owners' Association of Rhodesia, as convener, the following committee has carried out the task entrusted to it:—Messrs. R. Aserman, Bulawayo; J. Austen, Que Que; G. J. Austin, Mazoe; H. S. Bawden, Shangani; J. G. M. Bernard, Arc-turus; W. E. Biddulph, Selukwe; J. H. Bookless, Bulawayo; T. Bradshaw, Trevelloe Estate, Shangani; J. Brebner, Bulawayo; P. O. Brocklehurst, Enkeldoorn; C. F. Browning, Salisbury; R. O. Carruthers, Belingwe; J. A. Chalmers, Lynwood Estate, Ngamo; W. R. Chennels, Bulawayo; S. A. S. Colborne, Umvukwes; A. Coles, Gwelo; B. I. Collings, Salisbury; P. D. Crewe, Wankie; H. Cumming, Gwelo; J. Dalton, Gatooma; L. T. Dechow, Bulawayo; G. A. Dobbin, Salisbury; C. R. Edmonds, Bulawayo; J. A. Edmonds, Salisbury; J. T. English, Umtali; W. D. Estment, Plumtree; V. M. Ewing, Inyati; Major C. D. Fellowes, Shagari; R. le S. Fischer, Coldstream Ranch, Headlands; R. A. Fletcher, Redbank; Sir Reginald Ford, Balmain Estate, Mashaba; R. H. Futter, Makwiro; H. P. Fynn, Bembesi; L. Glanfield, Salisbury; Major Gordon, D.S.O., Bulawayo; P. H. Gresson, Salisbury; J. H. Halliday, Victoria; A. G. Hadingham, Filabusi; T. Haddon, Que Que; S. H. Harnden, Rusape; J. Haskins, Francistown; A. G. Hay, Bulawayo; H. S. Henderson, Filabusi; S. Herud, Selukwe; Sir Melville Heyman, Bulawayo; H. Hibbert, Umvuma; H. M. Huntley, Bulawayo; C. S. Jobling, Bulawayo; L. Lloyd, Gorubi Springs, Inyazura; W. M. Longden, Melsetter; J. L. Martin, Melsetter; J. Meikle, Mountain Home, Umtali; T. Meikle, Bulawayo; Geo. Mitchell, Bulawayo; W. J. Morgan, Nyamandhlovu; C. C. Macarthur, Salisbury; W. J. McCulloch, Hartley; T. McMurray, Syringa; Sir Francis Newton, Pimento Park, Salisbury; S. O'Keefe, Lochard; A. W. Partridge, Salisbury; A. Peake, Umvukwe Ranche, Banket

Junction; J. Rademeyer, Salemore, Victoria; O. Rawson, Darwendale; A. G. S. Richardson, Lochard Siding; J. P. Richardson, Essexvale; Léo Robinson, Essexvale, L. R. Robinson, Makorsi River Ranche; W. H. Rodgers, West Nicholson; E. Scott, Concession; J. Stewart, Shangani; A. Strickland, Penhalonga; J. Struthers, Victoria; W. F. White, Figtree; J. Williams, Victoria; G. C. Woodforde, Eiffel Flats; Dr. Worthington, Gwelo.

As representatives of public bodies and companies the following were also appointed:—

Department of Agriculture—The Director of Agriculture.

Veterinary Department—The Chief Veterinary Surgeon.

Commercial Branch, B.S.A. Company—W. Olive.

Estates Department, B.S.A. Company—C. D. Wise (alternate P. Hensman).

Union Miniere—M. Herself.

B. & M. & R. Railways—Col. Birney (alternate G. Ross).

Municipalities—Umtali, Councillor J. Meikle; Bulawayo, Councillor H. R. Barbour; Salisbury, Councillor Dr. Appleyard; Gwelo, Councillor Jacobson; Gatooma, Councillor R. W. Albertson.

Village Management Boards—Umvuma, W. van Heusden; Victoria, J. A. Halliday.

Odzi Canning Factory—J. Meikle.

Matabeleland Farmers' Co-op, Ltd.—R. A. Bland, Shangani.

Farmers' Co-op, Ltd.—J. Pascoe, Salisbury.

The Standing Committee of the Agricultural Union.

The Executive Council of the Cattle Owners' Association.

B.S.A. Company's Ranches—Rhodesdale, Major G. F. Chomley; Nuanetsi, R. Kelly.

Liebig's Extract of Meat Co., Ltd.—R. McKenzie.

Mashonaland Agency, Ltd.—A. G. Stewart Richardson.

Rhodesia Lands, Limited—Major Heydeman.

Farm Lands of Rhodesia—S. Valentine.

Rhodesia Exploration and Development Co., Ltd., and Transvaal and Rhodesia Estates, Ltd.—J. P. Richardson.

N.W. Rhodesia Farmers' Association—F. J. Clarke, M.A.C., Kafue.

This very representative committee has now prepared and submits its report, which it is hoped will prove of interest to all connected with the cattle industry in Southern Rhodesia, and to a large circle of those concerned in the subject in other lands.

The task set to the committee is to describe concisely yet comprehensively the state of the cattle industry of Southern Rhodesia and of conditions natural and economic influencing it at the present time, indicating the advantages it enjoys and the drawbacks under which it labours and the possibilities of its expansion. To this end all interests have been consulted and many sources of information tapped. Help has very willingly been accorded by the farmers and cattle owners of the country individually and through their associations, by dealers, butchers, buyers, merchants, wholesale and retail, consumers, officials, by the Railways, Municipalities and other public bodies, both within the country and beyond it, and from a vast number of separate views and

facts a consensus of opinion and of information has been here brought to a focus. This result could only have been attained by the willing co-operation of those familiar with each branch of the subject, and would have been very difficult, probably impossible, for a stranger to have collected and collated independently. It is of course open to all to examine the statements here made and to verify the facts; indeed cattle owners would welcome such investigations as indicating an interest on the part of potential consumers of the finished product of their veld, the fat ox, by anyone meditating entering the business of exporting beef and inaugurating meat freezing and packing works. In the preparation of this monograph it has been fully realised that, whether conducted by the same individuals or not, there are two very distinct aspects of the subject, and that the cattle industry ends where the meat industry begins.

It is not proposed in these pages to discuss the contentious question of the best means of establishing freezing works in Rhodesia or the formation of companies, co-operative or otherwise, to that end, but it is hoped that the statement of the position here tendered may furnish definite information and clear away many misunderstandings and misconceptions and so reduce the difficulties and doubts on the subject in order that these problems may be rendered easy of solution. Agreed upon the outstanding facts, the decision as to the methods to pursue in exploiting the industry should not cause much difference of opinion if common sense and common interests can prevail. Having collected the data, it may be left to the financial and technical expert, after verification and scrutiny, to devise ways and means for turning the latent possibilities of the situation to account.

ERIC A. NOBBS,

Director of Agriculture.

Salisbury,

20th May, 1921.

Introductory.

AIM OF MEMORANDUM.

It is the object of this memorandum to give such an exposition of the present position of the cattle industry in Southern Rhodesia as will enable persons interested in and conversant with meat export and kindred industries to decide as to the feasibility of initiating a regular trade now or at an early date in Southern Rhodesia. It is desired to assist them to form an opinion as to the prospects of establishing a profitable trade in beef and carcase bye-products both locally and overseas, and the facts now presented and vouched for authoritatively should serve as a guide to anyone possessing the necessary knowledge and experience of the manufacturing and commercial aspects of the business. The aim of the compilers has been to present a statement of the case which is accurate, instructive and comprehensive, without bias or conscious misrepresentation.

The supply of cattle in the Territory has already far outstripped local requirements, and is rapidly increasing, and the number of people engaged in cattle raising is expanding. The interests of the cattle owner and the country at large alike demand that the whole subject of the production of meat and its advantageous disposal in the markets of the world shall be considered before the necessity for finding outlets for our surplus has created a multiplicity of small uneconomical undertakings and created interests which will form obstacles in the way of a comprehensive scheme, capable of putting every cattle owner in the country in touch with the world's markets.

That the present time is opportune for a review of the position is clearly shown by circumstances which are familiar to those who have an interest in the subject. New markets are developing just outside our borders, and there is every indication that before long Southern Rhodesia will be able to claim a share in supplying the older established markets in Europe. Quite recently the possibilities of the Rhodesian meat industry have attracted attention from outside. Representatives of two meat exporting companies in the Union have recently completed tours of inspection here, and tentative enquiries on the same subject have been made from overseas. The trade which cattle owners here have already built up with that large consuming centre, the Witwatersrand, has attracted the attention of the Municipal authorities there and buyers from all parts of the Union. It is clear, therefore, that a forward move is indicated, and it is to satisfy preliminary enquiries in an authoritative way and to give all possible help and encouragement to such welcome investigations that this statement has been prepared. With the information here furnished before them, it is thought that those competent to judge should be able to decide as to the best procedure for the development of the meat industry and to determine matters relating to sites, facilities, transport, capital and so on.

An important consideration is that there is now a clear field for the pioneer in this business, untrammelled by vested interests or long existent opposition, such as was the case with the early freezing works and the old saladeros of South America. The advantages of the pioneer as regards choice of location, unimpeded development and early connections are with those who seize the appropriate and psychological moment for establishing themselves and nursing a manufacturing industry which, if comparatively small at first, must necessarily eventually, when the difficult teething period is over, become a large and remunerative business.

By detailing the circumstances under which our cattle are raised, their character, numbers, origin, type, quality and weights; by describing present conditions, markets and prices, and by indicating the increase and development likely to take place in the early future, we desire to furnish so clear a statement of the position that it will be comparatively simple for anyone familiar with the manufacturing and commercial aspects of the subject to form accurate conclusions as to the prospects of the industry.

Without a preliminary enquiry of this nature it would be dangerous to formulate plans. For a stranger to collect the information here

presented would be most difficult and costly, probably impossible, whilst the representative character of the signatories to this report conveys a guarantee and weight which no individual communication could command. Every endeavour has been made to substantiate and check each statement and figure, whilst in matters of opinion those most competent to express views have been consulted, and on most points a consensus of impressions from several sources has been collected. Much of the statistical matter is new, or has been brought together for the first time, whilst all the information has been specially collected and authenticated for publication here.

Throughout the compilation of this statement the distinction between cattle raising and the meat industry has been recognised, and no attempt is here made to deal with any part of the subject beyond the production of the raw material—the live beast, with which the meat industry commences operations, and which it converts by highly specialised processes into scores of different articles, employing to this end much capital, skill and labour, and commercial organisation of a complex character, entailing world-wide ramifications.

The scope and possibilities of the subject as a whole may with advantage be briefly indicated. We have in Rhodesia, after omitting fly belts, 92,670,000 acres fit for cattle. We possess to-day one-and-a-half million cattle, or one to 62 acres, and it is estimated that in time we can reduce this proportion to one beast to ten acres or twelve acres, which means a total cattle population of from seven and three-quarters to nine and a quarter million head. At the present rate of increase this figure might be reached in 1937. If, as is probable, the present fly areas one day become possible for cattle, the ultimate figure may be increased. The value of our exports of cattle and bovine products, according to Customs returns, was £412,432 in 1920.

“A wide outlook upon the world’s supplies of meat and its steadily expanding requirement would seem to indicate that demand is tending to overtake supply, largely as the result of a steady growth in the white populations of the world and an improving standard of living, but partly as a direct consequence of the great war. It is estimated that whereas fifty years ago there were 300,000,000 potential meat eaters in the world, there are to-day 587,000,000.”

“The war destroyed the last remnants of prejudice against frozen meat in this country; and on the Continent it did the work of 20 years of peaceful penetration.”

These statements are taken from Messrs. W. Weddel & Co.’s thirty-third annual Review of the Frozen Meat Trade, 1920, and such authoritative pronouncements demand the serious attention of all meat producing countries, especially of the younger ones, such as Rhodesia, which, with its considerable numbers of cattle and its rapid rate of increase, has not yet been directly drawn upon to supply the world’s needs. Elsewhere in the same Review we read:—

“During its comparatively brief existence the meat export trade of South Africa has undergone a good many vicissitudes, as evidenced by the varying yearly shipments. Last year only 5,645 tons were exported, as compared with 19,942 tons in 1919, 8,354 tons in 1918,

21,096 tons in 1917 and 7,928 tons in 1916. Freight was very short in the early part of the year; and later on, when more tonnage was available, shippers found they could not then export owing to local values being relatively higher than those obtainable on this market. The whole of the 1920 output was shipped to the United Kingdom and sold at prices averaging about 1½d. per pound under the 'official maximum price' ruling for imported beef. Unfortunately no improvement in either quality or dressing was discernible during the past year."

And again we quote:—"It is greatly to be regretted that the meat export trade of South Africa has fallen on evil days as compared with its war time activities; but unless the farmers of the Union lay themselves out more earnestly than hitherto to improve their herds by suitable breeding and feeding, to grow animals for butchering only, and not mainly for draft purposes, and finally, to select and grade the carcasses with a view to meeting the needs of the European markets, it is impossible to treat their efforts to open up an export trade as a serious proposition."

These strictures on the Union meat export trade deserve earnest attention, but happily we may claim for Southern Rhodesia, even in the present nascent state of the industry, that the systematic improvement of our cattle has already made considerable advance; that the sale of cattle which have never known the yoke is now general; and that the proportion of grade stock is already high and rapidly rising. Therefore, even by the time any local freezing works could be in operation the position should be much better than that described in the above passages relating to the Union.

Chapter I.

DESCRIPTION OF THE COUNTRY.

Southern Rhodesia, a country considerably larger than the United Kingdom and equal to the Transvaal, Orange Free State and Natal together, contains no arid deserts, and no swamps or other land permanently unsuitable for cattle. Whilst this report deals in detail only with Southern Rhodesia, containing to-day one-and-a-half million cattle, yet it is to be remembered that any development of the meat industry would involve participation by adjoining territories which are favourably situated geographically in regard to any freezing works erected there. Such regions include the northern half of Bechuanaland, particularly the Tati Concession and Ngamiland, the northern borders of the Transvaal and portions of Northern Rhodesia accessible to the railway. These regions contain approximately 500,000 head of cattle. This figure is arrived at by assuming from recent statistics for northern Bechuanaland, including Tati Concession and Ngamiland, 200,000 head, for Waterberg and Zoutpansberg districts of the Transvaal 250,000 (the quinquennial census of 1918 gives 223,774), and for European owned cattle in Northern Rhodesia 50,000 head. For distribution other than to the world's market oversea we have to take into consideration the

Rand, Pretoria and Kimberley markets; also Southern Rhodesia, Northern Rhodesia, the Belgian Congo and the Mozambique Co.'s territory of Portuguese East Africa down to the port of Beira.

Pastoral Area.—The total area of Southern Rhodesia, however, is not uniform nor alike in its suitability for carrying cattle, and certain allowances or deductions have to be made on this account. Certain portions consist largely of arable land, a fact which enhances their stock carrying capacity for grazing, fattening and dairying, if not for ranching purposes. The area under cultivation in 1920 was:—

European	210,000 acres or	328 square miles
Native	1,203,755 acres or	1,881 square miles

Total 1,413,755 acres or 2,209 square miles

Some parts have already shown themselves to be capable of carrying more cattle than others; great stretches have not yet been beneficially occupied, and others are as yet only very sparsely peopled. One large deduction must be made consisting of 8,450 square miles or 5,408,000 acres of country which is to-day unsuitable for cattle owing to the presence of tsetse fly. There is reason to hope, however, that with the progress of civilisation and science these regions should not be permanently excluded. For the purpose of calculating the present stocking, we must reduce the cattle area of Southern Rhodesia to a matter of about 144,800 square miles or 92,670,000 acres. It is estimated that 60 per cent. of this total area, or 86,880 square miles, is covered by various types of indigenous forest, but this is not as a rule too dense to provide grazing, being mainly of the savannah character, and valued for the shelter it affords as well as the good grazing within its shades.

Character of the Country.—The configuration of the country is simple. For the main part Rhodesia consists of a gently rolling plateau varied by ranges of low kopjes, the whole lying at a general altitude of 3,000 to 5,000 feet, falling away north and south to about 2,000 feet. The northern and southern boundaries are marked by great river valleys, lower country, hotter and with less rainfall, than on the tablelands. The eastern border consists of a mountain chain approaching at points to 9,000 feet above sea level, a narrow strip running north and south, rather different in character from the rest of the country. As well as the large Zambesi and Limpopo Rivers, forming respectively the northern and southern boundaries, smaller rivers traverse Rhodesia in all directions. Those in the western portion of the Territory are apt to be empty in their upper reaches, though often carrying water below the surface of their dry and sandy beds throughout the winter season. In the eastern half of the country the rivers are much more permanent, and much of the country is exceedingly well watered with perennial running streams. Underground water supplies at no great depth have been located in the past, and no apprehension on this score need generally be entertained, although, of course, some experience is necessary in selecting suitable sites for boreholes or wells.

Severe droughts such as obtain in the Union of South Africa and in Australia are unknown, and the rainfall regularly averages from

20 to 40 inches, with more in parts. While rapid changes in temperature are of frequent occurrence, and though light winter frosts are usual, cattle rarely if ever suffer from cold to any appreciable extent, and the mean elevation of most of the country prevents anything like excessive heat.

The soils of Southern Rhodesia may be roughly divided into two main types—light sands and moderately heavy loams, with many intermediate forms between these two. The major part of the country is what is termed sand veld, derived from granite rock, though areas of sand veld derived from sandstone formations occur in certain districts. The heavier type of soil is commonly referred to as "formation," and it is in this that the chief mineral deposits have been located; it is here also that the most fertile soil is to be found. In almost all districts the two main types are to be met with in varying proportions. Speaking broadly, the bulk of the heavier soils is found in the districts of Insiza, Gwelo, Hartley, Salisbury, Mazoe, Lomagundi and Umtali; also in Wankie, Nyamandhlovu, Bubi, Bulawayo and Gwanda. The most sought after parts of the country lie on what is known as the "contact"; that is along the dividing lines between formation and granite, where the admixture of sands, clays and loams produces ideal conditions both for agriculture and stock raising. Speaking generally, the formation grazing is at its best in heavy wet seasons, and the sand veld in medium to dry years. Of late the sand veld has been gaining considerably in reputation and has much enhanced its popularity.

Herbage.—The main types of grasses follow the usual South African lines of distinction and are broadly classified as "sweet veld" and "sour veld." Both types are found on all varieties of soils, though sweet veld is more plentiful in formation and contact country. With regular stocking and systematic but not too close grazing down, the sweet grasses tend to increase rapidly, and this advance can be greatly assisted by checking the grass fires, which even to-day sweep through the country every winter, and by regulating depasturing by means of fenced paddocks. Sour veld grasses are usually deep rooted and drought-resisting, and it would be a pity to see these altogether wiped out of existence. The grasses of the country are chiefly tufted in habit of growth, but tend to mat and consolidate when well stocked and protected from veld fires. As is to be expected, in the drier districts of the south and west, the grass is fairly short and is usually described as sweet veld, indicating that even when dry in winter the majority of the species are still palatable and nourishing to stock. This is not altogether the case in the granite areas, however, where a good deal of sour veld is encountered, but this is offset by the fact that in such areas many of the vleis retain moisture throughout the dry season, and when well fed down or burnt produce a new succulent growth of grass some weeks before the rainy season commences. In districts of heavier rainfall growth is coarser and ranker, and on the richest soils grasses six to ten feet in height are met with. Such veld naturally requires longer and heavier stocking before it becomes tamed, but owing to the rapid increase in cattle and the wider settlement of the country, great

improvement in this respect has taken place during the last few years. In certain of the hotter parts of the country short curly grasses occur, which are of a specially nutritious character and much relished by cattle.

Bush.—Throughout the country forest, or, as it is locally designated, bush, is of frequent occurrence, and most districts may be described as park-like. The trees are found on the rising ground, while the valleys or vleis are generally open, and this fact creates at first sight the illusion that the whole country is covered with bush, whereas when traversed it is found to contain much open land, pleasantly sheltered by trees on the ridges. Most, but not all, of the timber is soft and unsuitable for use in permanent buildings or for fencing purposes. Hard woods do occur, but are much scattered and do not usually amount to any large quantity on any particular farm or ranch.

Over large parts of the country open rolling grass-land, similar to that found on the high veld of other parts of South Africa, is to be met with. Much of Southern Rhodesia may be said to be bush veld, of varying density, but usually only sufficiently so to render the Territory the excellent cattle country that it is. In certain localities, such as that bordering the Victoria Falls line and in parts of the Gwelo and Hartley districts, the bush is dense, and until it is thinned out the grazing suffers in consequence. One of the peculiar characteristics of the trees of Southern Rhodesia is their habit of throwing out the young spring growth as soon as the weather becomes warm and weeks before the rain breaks. In spring, especially if the grass is late in commencing growth, the young leaves and shoots of the trees, many of which are legumes, afford palatable and nutritious feeding for both native and grade cattle, and also for sheep and goats. Many of the trees produce pods containing beans which form a favourite diet of cattle and wild game.

Climate.—Southern Rhodesia lies between the parallels of 15° 30' and 22° 30' south latitude. It is therefore wholly within the tropics, but owing to its altitude its climate may generally be described as varying from temperate for localities at an altitude above 4,000 feet to sub-tropical for localities under 3,000 feet altitude.

The average annual rainfall throughout the Territory varies from over 45 inches along the mountainous country on the eastern border to under 20 inches in the southern portion of Gwanda and Chibi districts. Broadly speaking the distribution of average rainfall in Southern Rhodesia may be said to diminish with distance from the coast and increase with altitude. The rainy season extends from the middle of October to the end of March. The rainy season again is divided into two periods, viz., from middle October to end of December and from January to end of March. The rains occurring during the first period are known as **spring rains**. These are patchy and local in character, and are generally accompanied by thunderstorms. The spring rains have very nearly the same average all over the country. The rains occurring during the second period are known as **summer rains**. They are more general in character and decrease markedly in intensity from east to west.

The following table shows the average precipitation per month for Mashonaland and Matabeleland:—

Division.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Mashonaland ...	0·04	0·07	0·35	1·16	3·04	5·73
Matabeleland ...	0·06	0·04	0·15	0·90	3·46	5·50

Division.	Jan.	Feb.	March.	April.	May.	June.
Mashonaland ...	7·58	7·59	4·38	1·07	0·52	0·07
Matabeleland ...	5·72	3·48	2·82	0·79	0·27	0·04

Division.	Winter Rains April—Sept.	Spring Rains Oct.—Dec.	Summer Rains Jan.—March.	Yearly Average.
Mashonaland ...	2·12	9·93	19·55	31·60
Matabeleland ...	1·35	9·86	12·02	23·23

From this it will be seen that the winter rains throughout the bulk of the country are negligible except along the eastern border, where they average 4.91 inches.

The mean annual temperature of the Rhodesian plateau (altitude 3,500 to 5,000 feet) is about 65 deg. F., with a mean annual maximum of 79 deg. F. and a mean annual minimum of 51 deg. F. The fluctuation in the monthly mean temperature varies from 56 deg. in coldest month (June) to 73 deg. in hottest month (October). The mean monthly maximum temperature in June is 72 deg. and in October is 90 deg. The mean monthly minimum temperature in June is 41 deg. and in October is 56 deg. October is the hottest month as regards day temperatures; after this date there is a decrease in the day temperatures owing to the prevailing cloudy weather, but there is an increase in the night temperatures up to February. During this month the mean monthly minimum temperature is 59 deg. Absolute maximum temperatures of 90 deg. to 96 deg. are common on the plateau during October and November. One abnormal temperature of 102.2 deg. was recorded at Salisbury in December, 1913. Frosts may occur during the period middle May to middle August, and are common during the months of June and July, particularly in low-lying lands, but a record more than 5 deg. below freezing point is extremely rare. The temperature naturally varies greatly with the altitude of the locality under consideration.

The mean relative humidity varies from about 80 to 85 per cent. during rainy months to 35 to 40 per cent. in the winter months.

Communication.—Railways traverse the country in two main lines, and there are seven branches tapping remote districts. Extension of the system is only a matter of time. Roads, though often criticised, are sufficient to enable motor cars to run all over the country as easily as other vehicles, flooded rivers in the summer being the chief obstacle. The unmade up-country roads are no worse than those of Australia or South America, and trunk roads are being systematically pushed out as funds allow. Movement of cattle is provided for by outspan rights, which attach to most titles to land, and allow for legitimate travelling without undue delay. The length of railway journeys is a drawback, and the distance to the present markets in the Union is an undoubted burden and permanent objection to the conveyance of live cattle. The remoteness of our markets, as will appear later, constitutes one of the strongest grounds in favour of the local handling of meat, and the duration of the journey under very trying conditions is an obstacle to the export of live cattle and a cogent argument in favour of meat freezing works at a central point in Rhodesia.

The distance from Bulawayo to Johannesburg is 681 miles, and live stock have to travel in addition, from Victoria 234 miles, from Gwelo 111 miles, from Salisbury 299 miles, to mention only leading points on the railway.

From Messina, in the Northern Transvaal, after a journey of days or weeks on foot, cattle have to travel by rail 391 miles to Johannesburg, or 783 miles to Maritzburg in Natal, or 430 miles to Delagoa Bay.

At present for lack of better facilities these long journeys have to be allowed, involving high freight, waste of meat, loss from bruising, depreciation in the quality of the flesh and hardship to the cattle. If other alternatives existed, then on grounds alike of interest and humanity, laws corresponding to those in other cattle countries would no doubt be brought into force governing the duration of journeys by rail automatically, and incidentally favouring trade to the local centres.

Accessibility to Railways.—Another important feature is the ease of reaching the ranching areas and the distance of these from railways. Within 25 miles of a railway there are about 33,090,000 acres, and within this zone will be found most, though not all, the arable and mixed farming areas. Between 25 and 50 miles from a railway the extent is 25,790,000 acres, and the remaining 38,720,000 acres lie beyond the 50 miles line. In this connection it is of interest to note that within Southern Rhodesia there are 1,167 miles of railway, and that the distance to the coast is: (1) from Umtali to Beira, 204 miles; (2) from Plumtree to Durban, 1,097 miles; (3) from Messina, near the southern border, to Lourenco Marques, 430 miles.

Local Centres.—Two towns of importance, Salisbury and Bulawayo, and several smaller ones, such as Umtali, Gatooma, Gwelo and Victoria, besides a number of villages, serve as centres of distribution to the rural community, which consists not only of farmers and ranchers, but also to a notable extent of miners and traders. At these points markets exist where the trade in cattle is carried on, breeding

SOUTHERN RHODESIA.—OWNERSHIP OF LAND.

(Approximately as at 1st January, 1921.)

District.	Area of District.	Area Unalienated	Native Reserves.	Privately Owned.				Area of Townships and Commonages
				Area used for General Farming.	Area used for Cattle Raising.	Area Unoccupied.	Alienated Land Unserved.	
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
MATABELELAND—								
Belingwe	2,850,560	930,649	1,106,452	18,983	274,898	513,090	6,488	Nil.
Bubi	4,505,840	1,863,932	1,120,638	204,843	566,294	820,148	19,985	Nil.
Bulalima-Mangwe ...	4,325,120	1,493,836	1,254,412	443,131	474,102	529,821	128,710	1,108
Bulawayo	350,720	Nil.	Nil.	182,447	89,212	54,516	Nil.	24,545*
Gwanda	5,079,040	2,497,862	225,411	26,499	871,470	1,372,892	81,657	3,249
Gwelo	4,433,280	2,229,405	205,850	207,571	841,853	583,147	287,276	18,079*
Inyanga	1,920,000	294,062	64,321	270,139	653,682	637,796	Nil.	Nil.
Matobo	1,138,560	249,707	176,010	169,252	182,928	360,136	527	Nil.
Nyamandhlovu ...	2,782,080	728,324	1,100,000	260,762	157,458	526,463	9,073	Nil.
Sebungwe	9,719,680	3,592,729	1,069,487	4,095	Nil.	23,369	Nil.	Nil.
Selukwe	992,640	55,764	158,740	123,269	204,594	348,517	99,117	2,639
Umzingwane	602,880	Nil.	4,764	147,594	96,336	354,186	Nil.	Nil.
Wankie	6,960,000	6,144,689	317,481	114,907	148,562	212,903	21,458	Nil.
Total for Matabeleland ...	45,750,400	25,081,049	6,833,575	2,233,492	4,561,389	6,336,984	654,291	49,620
MASHONALAND—								
Charter	3,296,880	637,821	1,556,095	510,307	279,897	303,346	1,858	7,556
Chibi	7,532,800	2,875,202	1,410,106	9,522	3,237,970	Nil.	Nil.	Nil.
Chilimanzi	1,210,880	63,076	282,764	145,650	435,411	283,917	Nil.	62
Darwin	3,240,320	1,862,104	1,062,980	18,489	7,386	154,283	105,078	Nil.
Gutu	1,644,800	565,029	660,826	69,345	213,913	98,762	36,925	Nil.
Hartley	4,285,440	2,149,581	396,984	416,393	805,852	424,234	81,116	11,270*
Inyanga	1,726,720	436,828	247,518	169,024	786,633	Nil.	Nil.	Nil.
Lomagundi	9,000,000	6,922,510	887,274	536,325	157,989	903,140	190,073	2,689
Makoni	2,321,280	237,849	637,038	506,071	189,262	733,357	13,180	4,543
Marandellas	1,566,080	62,336	395,131	400,043	67,601	608,108	30,595	2,266
Mazoe	1,710,080	31,650	320,189	629,101	131,071	417,665	174,910	5,484
Molsetter	2,064,000	756,563	426,769	383,332	87,146	396,199	Nil.	13,991
Mrewa	1,717,120	390,099	1,170,284	51,634	37,131	63,752	4,220	Nil.
Mtoko	1,866,240	1,241,620	520,880	Nil.	97,727	6,013	Nil.	Nil.
Ndanga	3,640,440	1,800,270	1,258,446	49,015	677,120	122,389	42,200	Nil.
Salisbury	1,479,040	23,478	469,381	641,349	21,318	294,009	8,060	21,445*
Umtali	1,649,920	30,302	572,197	199,046	171,076	612,232	43,942	20,435*
Victoria	1,466,880	133,716	321,339	170,669	449,594	209,295	166,578	15,689
Total for Mashonaland ...	52,327,920	20,220,124	12,626,221	4,832,608	7,227,488	6,417,334	898,715	105,430
Grand Total	98,078,320	45,301,173	19,459,796	7,066,100	11,788,877	12,754,318	1,553,006	155,050
Percentage	...	46.9	19.84	7.21	12.02	13.00	1.58	.16

* Acreage of commonages, etc., held under title :—Bulawayo, 23,146; Gwelo, 13,248; Gatooma, 4,634; Salisbury, 20,118; Umtali, 13,216.

stock bought and slaughter stock sold for local consumption in towns and on mines, and for export to the Rand. The larger towns possess stockyards adequate to the present scale of operations, with railway facilities, pens, water, weigh bridges and dipping tanks. Similar arrangements are being established at various country centres. The trade of the country is and always will remain mainly a public one, private bargaining except as regards native trade not being much in favour.

Ownership of the Land.—A tabular statement showing the ownership of land in Southern Rhodesia, specially prepared for this memorandum and now published for the first time, brings to light a number of interesting points not hitherto definitely known in respect to the country as a whole and to each district. Here it is only proposed to deal with matters particularly affecting the cattle industry. It appears that of the entire Territory 45 per cent. is still unalienated, and, according to a recent decision of the House of Lords, is regarded as Crown land; 20 per cent. is set aside definitely and in perpetuity as native reserves, and a small fraction, .16 per cent., is assigned to townships, while the remainder, or about 33 per cent., is privately held by Europeans for farming purposes. This latter area, amounting in all to 33,162,300 acres, has been further classified, and it is found that 57 per cent. is actually in occupation, about 4.6 per cent. is unsurveyed land in course of transfer, and the rest, over 38 per cent., is held by absentee owners both companies and individuals. Such idle and vacant land is a hindrance to progress and a burden upon the community. Fortunately, of late a tendency has been shown in some quarters to realise the unearned increment in value of such land, and these areas are likely soon to pass into the hands of those who will beneficially occupy them. This "locked-up" land includes some of the best in the country, having been taken up speculatively in the early days, and beneficial occupation may now reasonably be looked for at an early date. The figures in the second and sixth columns will therefore shortly undergo material diminution in favour of those in the fifth column. The area devoted to mixed farming, shown in the fourth column, is also increasing rapidly, correspondingly reducing the unalienated and unoccupied areas. To a certain extent the ranching land will in time, no doubt, be cut up into smaller holdings, though never to the same degree as has taken place in America or Australia, for most of our pastoral land is not suitable for any other purpose.

Market Price of Land.—Figures have been collected from all quarters relating to the present price of land. On this head there is some divergence of opinion. An impression appears to exist abroad that good land can be had in Rhodesia for a song, but the days when that was true are long since past. Still, the price of land is comparatively cheap contrasted with other countries, and when the attractions of Rhodesia are considered. It is true that some prospective settlers have been disappointed, but to those familiar with the land it is somewhat difficult to imagine what such persons expected. The price of land has constantly advanced, and of late more rapidly, and the figures

given below cannot be regarded as fixed, and are likely soon to be exceeded. On the one hand, it is not the lowest priced land that is always the best value; on the other, some proprietors have inflated ideas of the worth of their own particular holdings, but on the whole there is a recognised standard for different classes of land. To consider first ranching land sold in large blocks, which is essentially pastoral country not at present adapted perhaps for smaller subdivision, though in time some of it may be cut up. Such land will, of course, vary in price according to its situation, accessibility, altitude, natural advantages, as to the quality of grazing, shelter, water, surroundings and the many other factors which only inspection can determine. Generally it may be said that such land is procurable at from five shillings to ten shillings per acre, though instances are quoted of ranching blocks offered at three shillings and four shillings per acre, and other land, also pastoral and not described as suitable for cultivation, at twelve and sixpence up to twenty and even twenty-five shillings per acre. Land suitable for arable farming, with possibly some improvements or special advantages, costs to-day from twenty to sixty shillings per acre, and in some cases as high as five pounds has been paid. In the case of developed farms of course the value of homesteads, fencing, orchards, plantations, irrigation works, dips, roads, ploughed land and so forth must be considered. Taking the sand veld as a whole, examination of current prices shows a large range of from five to fifteen shillings per acre. For corresponding farms on the red soils the limits are from ten shillings to five pounds per acre, most varying between fifteen shillings and one pound. Again allowance must be made for position, character, water supplies, the reputation of the district and so on, whilst it is to be remembered that many farms possess both sandy soils and loams, and that many of the former may be more desirable than the latter, that in fact it is a classification of types, not of value or productiveness. Lastly, in the sale and purchase of land in Rhodesia there is much room for the exercise of knowledge and foresight as well as speculative acumen, experience and ability.

Chapter II.

STATISTICS.

Number of Cattle in Southern Rhodesia, 1911-1921.—Tradition, or rather the recollection of natives going back some thirty years, describes the country now known as Southern Rhodesia as teeming with cattle, but closer interrogation leads to the impression that these cattle were mainly concentrated within reasonable reach and protection of the Matabele forces, and that the back country was correspondingly denuded of stock by systematic tribute and pillage. It seems likely that before the British occupation of the country cattle were not more numerous

than they are to-day, probably rather less so if the testimony of natives is to be relied on. Then came wars, rebellion, rinderpest, pleuro-pneumonia and African coast fever, and, although the first-named disease appears to have been attended by a simultaneous disappearance of tsetse fly, yet herds of Southern Rhodesia dwindled so that in 1911, when first we have authentic records, the total is given as only 371,000, less than one-fourth of what it is to-day, and probably the minimum and turning point in the curve. It has been possible to distinguish between European owned and native owned cattle, but owing to the suspicions and prejudices of the natives the number of cattle in possession of natives has until recently been based entirely on estimates, and is therefore somewhat less precise than the European figure, which is derived since 1914 from annual returns furnished by the individual stock owners. The general accuracy of the figures here given is confirmed by their consistency with one another, and their regularity in successive years. Graphically indicated, as in the accompanying diagram, we find a very steady uniform rate of progress from 1911 onwards, a line which compares favourably with corresponding ones for the same period in other countries. Reference to the table and diagram will show a more rapid rate of increase for the European than for native cattle, due in fact to better methods of treatment, but also to increase by purchase from the native and by importation from the south and overseas. From the year 1914 onwards annual statistics have been collected, which show an average rate of increase for native-owned stock of 9.85 per cent., for European-owned stock 13.6 per cent., and for both together 11.72 per cent. The figure corresponding to this latter for the Union of South Africa as furnished for the period 1904 to 1918 by the Director of Census is about 5 per cent.

NUMBER OF CATTLE IN SOUTHERN RHODESIA.

Year.	European-owned.	Rate of increase.	Native-owned.	Rate of increase.	Total.	Rate of increase.
At 1st January:						
1914 ...	310,000	10.2	385,000	5.5	695,000	7.6
1915 ...	341,878	15.4	406,180	9.8	748,058	12.4
1916 ...	394,856	18.6	446,060	10.1	840,926	14.1
1917 ...	468,504	13.6	491,522	12.2	960,026	12.9
1918 ...	532,311	12.8	551,632	10.5	1,083,943	11.6
1919 ...	600,447	13.0	610,100	6.9	1,210,547	9.9
1920 ...	678,508	12.0	652,776	14.0	1,331,284	16.0
1921 ...	760,065	...	744,400	...	1,504,465	...
Average for 7 years	...	13.6	...	9.85	...	11.72
Estimates:						
1922 ...	862,000	...	817,000	...	1,679,000	...
1923 ...	978,000	...	897,000	...	1,875,000	...
1924 ...	1,110,000	...	985,000	...	2,095,000	...

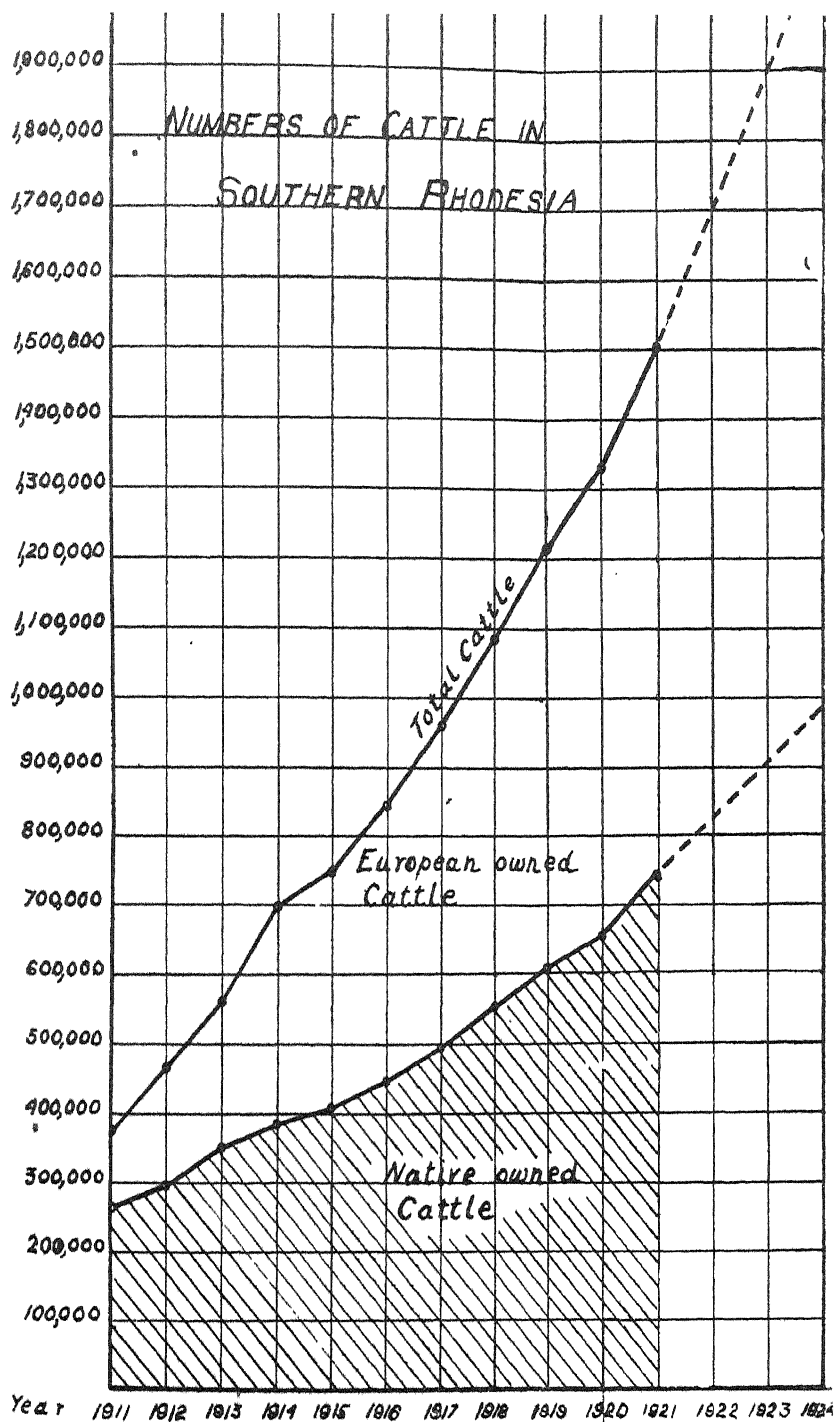
Forecast from the known to the probable future may reasonably be based on the averages of the past few years or by projecting forward the average line of the graphs. From either source we conclude that the two million level will be reached in 1924, and that the cattle available in the Territory for slaughter here or elsewhere will increase to 167,600 in that year, that is, 8 per cent. of 2,095,000, as shown elsewhere.

Number of Cattle in Adjoining Areas.—In regard to the source of supply for any freezing works which might be erected in Southern Rhodesia it is to be borne in mind that such a factory would also be nearer than any existing works to-day to several important stock raising areas in adjoining countries, and would command its share of something over two million cattle. The cattle available for slaughter out of these numbers appear ample to justify the establishment of freezing works. The cattle from the Northern Transvaal already have access to freezing works in the Union and Lourenco Marques, and the Congo markets have hitherto absorbed the supply from Northern Rhodesia, whilst Mozambique Co.'s Territory imports cattle from Southern Rhodesia. Numbers are, however, increasing faster than consumption in all these regions. These remarks are based on the figures shown in the accompanying table:—

NUMBERS OF CATTLE WITHIN RANGE OF FREEZING
WORKS IN SOUTHERN RHODESIA.

Country.	Date of return.	Cattle.	Estimate, 1921.
Southern Rhodesia ...	1/1/21	1,504,465	1,505,000
Northern Rhodesia ...	1921	388,103	388,000
Northern Transvaal (districts of Waterberg and Zoutpansberg) ...	1918	223,774	250,000
Northern half of Bechuana-land, including Ngami-land and Tati Concession	1920	200,000	200,000
Mozambique Co.'s Territory...	1920	35,854	37,000
		2,352,196	2,380,000

Numbers of Cattle in certain other Pastoral Countries.—The significance of figures showing the number of cattle in Southern Rhodesia and the rate of increase can only be fully and fairly appreciated by comparing these numbers with those of other cattle producing countries, and to this end the following tables have been prepared.



than they are to-day, probably rather less so if the testimony of natives is to be relied on. Then came wars, rebellion, rinderpest, pleuropneumonia and African coast fever, and, although the first-named disease appears to have been attended by a simultaneous disappearance of tsetse fly, yet herds of Southern Rhodesia dwindled so that in 1911, when first we have authentic records, the total is given as only 371,000, less than one-fourth of what it is to-day, and probably the minimum and turning point in the curve. It has been possible to distinguish between European owned and native owned cattle, but owing to the suspicions and prejudices of the natives the number of cattle in possession of natives has until recently been based entirely on estimates, and is therefore somewhat less precise than the European figure, which is derived since 1914 from annual returns furnished by the individual stock owners. The general accuracy of the figures here given is confirmed by their consistency with one another, and their regularity in successive years. Graphically indicated, as in the accompanying diagram, we find a very steady uniform rate of progress from 1911 onwards, a line which compares favourably with corresponding ones for the same period in other countries. Reference to the table and diagram will show a more rapid rate of increase for the European than for native cattle, due in fact to better methods of treatment, but also to increase by purchase from the native and by importation from the south and overseas. From the year 1914 onwards annual statistics have been collected, which show an average rate of increase for native-owned stock of 9.85 per cent., for European-owned stock 13.6 per cent., and for both together 11.72 per cent. The figure corresponding to this latter for the Union of South Africa as furnished for the period 1904 to 1918 by the Director of Census is about 5 per cent.

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Numbers of Cattle in certain other Pastoral Countries.—The significance of figures showing the number of cattle in Southern Rhodesia and the rate of increase can only be fully and fairly appreciated by comparing these numbers with those of other cattle producing countries, and to this end the following tables have been prepared.

It will be observed that within the South African sub-continent, that is south of the Zambesi and Cunene Rivers, there are to-day, approximately, ten million head of cattle, of which Southern Rhodesia possesses 1,500,000, or 15 per cent. The details are:—

Union of South Africa (1919)	7,255,758
Southern Rhodesia (1920)	1,504,465
Basutoland (1911)	437,411
S.W.A. Protectorate (1920)	300,000
Bechuanaland (1911)	323,911
Swaziland (1919)	160,000
Portuguese East Africa (Colonial) (1921) ...	190,775
Mozambique Co.'s Territory (1920)	35,854

10,208,174

Compared to Australia with 11,000,000 head and New Zealand with 3,000,000 head, the position of South Africa is not to be despised, even though considerable allowance must be made on account of slower average maturity. It is noteworthy that Rhodesia exceeds the figures available for Victoria, West Australia and South Australia.

Australasia (except recently annexed or mandated territories):—

Queensland (1918)	5,786,744
New Zealand (1920)	3,059,445
New South Wales (1917)	2,405,770
Victoria (1917)	1,371,049
West Australia (1918)	943,847
South Australia (1919)	342,768
Tasmania (1918)	197,900

14,107,523

It may be appropriate here to remind readers of the relative positions of some of the larger nations of the world in this respect, as shown below, and to mention incidentally that recent figures indicate that 29 leading countries each have over two million head.

India (including Native States) (1920)	132,537,521
United States of America (1-1-1921)	66,191,000
Brazil (1917)	30,705,400
Argentina (1918)	27,392,000
Australia (1920)	12,286,000
United Kingdom (1920)	11,770,300
Canada (1920)	9,477,380
Uruguay (1916)	7,802,000
Union of South Africa (1919)	7,255,000
Madagascar (1914)	6,784,000

Present Stocking and Distribution of Cattle.—In actual practice it is found that the larger stock farmers to-day carry on their land as a rule one beast to from 10 to 25 acres. As a very fair average and general rule it may be taken that the great majority of cattle owners carry one beast on from 10 to 20 acres with little or no extra feeding or attention in winter beyond choosing warm sheltered veld near to

water. Many cattle owners have now reached a stage when they have a beast to every 10 or 12 acres, generally paddocked and with winter feeding of hay or old cultivated lands to supplement the veld. Some farmers to-day carry one beast to 6 acres, including old maize lands and other artificial feed; others again, though a small minority only, have proportionately more land than the cattle need, and run their stock on very primitive lines, and only have three head per hundred acres; but extreme cases cannot be taken as a fair indication of the usual stocking found on ranches to-day. There are few, if any, farms which can claim to be fully stocked, and in this respect great fluctuations occur.

According to the attached table it appears that at 1st January, 1921, the number of cattle per square mile for the whole of Southern Rhodesia was 9.81 head, or one beast to 65.1 acres. To give a more reasonable indication of the position it would be proper, however, to omit the three districts lying along the Zambesi Valley, Wankie, Sebungwe and Darwin (one-fifth of the Territory), which cover 31,125 square miles and contain only 17,358 head of cattle. This region is very sparsely occupied, and includes virtually all the tsetse fly areas. This gives for the rest of the country 12.17 head of cattle per square mile, or 52.5 acres per head, and more truly reflects the present position of the inhabited areas, European and native. Even so, it is obvious that the country is far from possessing its full complement of cattle. Even the most densely occupied district, Matobo, with 43.4 head per square mile, is far from fully stocked, yet at that low figure there is room in Southern Rhodesia for 6,650,000 head of cattle, and at one beast to 10 acres the number of cattle would be 9,807,832 head. As no district can yet be regarded as fully stocked, these figures do not indicate the relative stock carrying capacity of different parts of the country, nor the utmost capacity to do so, but only the actual use at present made of the veld.

District.	Area of District in Square Miles.	Number of Cattle in District.	Number per Square Mile.
Belingwe	4,454	55,233	12·4
Bubi	7,181	66,571	9·2
Bulalima-Mangwe	6,758	91,987	13·6
Bulawayo	548	14,374	26·2
Gwanda	7,936	96,946	12·2
Gwelo	6,927	102,833	14·8
Insiza	3,000	73,276	24·4
Matobo	1,779	77,215	43·4
Nyamandhlovu	4,347	31,762	7·3
Sebungwe	15,187	1,225	·08
Selukwe	1,551	38,964	25·1
Unzingwane	942	16,680	17·7
Wankie	10,875	10,850	1·0
Charter	5,151	63,605	12·3
Chibi	11,770	101,662	8·6
Chilimanzi	1,892	66,211	35·0
Darwin	5,063	5,283	1·0
Gutu	2,570	37,847	14·7
Hartley	6,696	71,753	10·7
Inyanga	2,698	19,364	7·2
Lomagundi	15,000	39,084	2·6
Makoni	3,627	44,046	12·1
Marandellas	2,447	51,256	20·9
Mazoe	2,672	54,392	20·3
Melsetter	3,225	27,007	8·3
Mrewa	2,683	20,111	7·5
Mtoko	2,916	21,972	7·5
Ndanga	6,171	34,106	5·5
Salisbury	2,311	76,931	33·2
Umtali	2,578	15,593	6·0
Victoria	2,292	76,326	33·3
Total ...	153,247	1,504,465	9·8

Ownership of Cattle.—The distribution of cattle amongst European owners is a point of interest. The following were the figures at 1st January, 1920 and 1921 respectively:—

	1920.	1921.
Owners of 500 head and upwards	258	275
Owners of 1,000 head and upwards	70	100
Owners of 2,000 head and upwards	32	35
Owners of 5,000 head and upwards	6	6
Owners of 10,000 head and upwards	3	3
Owners of 20,000 head and upwards	3	3

258 275

Future Stock Carrying Capacity.—After consulting the farmers' associations of the Territory and obtaining the personal opinions of

a number of leading cattle men, an approximate estimate has been made of what should be the future utmost stock carrying capacity of the veld when fenced and adequately served with water supplies and tanks, but conducted on purely pastoral lines and not under mixed farming conditions. The estimates vary from 5 to 15 acres and centre round 10 to 12 acres per head. Probably 12 acres for the country at large represent the general belief. The poorer country will be compensated for by better tracts and by the important regions where dairying, mixed farming and cattle fattening can profitably be pursued, which will restore the stock carrying capacity of the country as a whole probably to the figure given above.

The Birth Rate.—The rate of increase of stock is a feature naturally closely watched and regarding which fairly accurate information is available. A variation of from 55 per cent. to close on 100 per cent. is recorded, not as mere opinions, but from actual count, from over sixty reliable sources, each relating to large herds. Whilst certain of the largest concerns have low returns due to primitive and extensive rather than advanced methods, some of the highest come also from ranches where very large numbers are kept, and where accurate stock records are collected and audited. The birth rate is lowest where crude methods are practised as to herding treatment and the care and use of bulls, and where the practice of kraaling at night is resorted to, and again where well bred stock are kept but not well cared for. Though a few returns as low as 55 per cent. have been received, a larger number of over 90 per cent., and from equally reliable sources, are recorded. The returns in the region of 65 to 70 per cent. are counterbalanced by as many between 80 and 90 per cent. Actually the figure most generally given is 75 per cent., and this may confidently be taken as the fair average, although varying between wide margins. Of returns received in reply to enquiries, two-thirds gave 75 per cent. or more, and less than one in twenty were below 65 per cent. Good management should certainly give this return of three births in four years from each cow, whilst some explanation and improvement is called for if it falls below that figure. Whilst the native cow is specially prolific, high returns are recorded from herds where much improvement has taken place; indeed it may be interesting to state the highest return was obtained from a herd of over 1,300 in which several hundred are pure bred, and the rest mostly of a high grade, all reared under veld conditions and given a minimum of housing. European breeds of cattle, when properly cared for, calve quite as regularly and frequently as does the native, but appear to be more susceptible to hardship, maltreatment or neglect. With the extension of fencing and the provision of natural protection and feeding for winter, there is no reason to fear that with the grading up of our herds their fecundity need diminish. It may happen that as the process of grading up progresses the death rate will rise in proportion as the cattle become more removed from the foundation of hardy native stock. On the other hand a very large percentage of all Rhodesian cattle are run under the old pernicious system of herding and kraaling, and as the practice of keeping cattle in fenced paddocks gradually grows, there is little doubt but that the many advantages of the latter system will be reflected in an improved birth rate.

Export of Cattle from Southern Rhodesia.—It is recognised that in the early future, outlets for our matured cattle must be found quite independent of mere extension of existing markets. To some extent substitutes for these markets must be found, in view of the liability to exclusion at any time, the probable increasing competition from regions nearer to the Rand markets and the objections due to the great distance and the trying character of the journey, disabilities in respect of sales, deterioration and bruising of cattle in transit. Though Johannesburg has undoubtedly proved an immense benefit since the market was opened in 1916, yet there are manifest drawbacks in reaching that market, and the expediency of seeking other means of disposing of our finished stock has now become a pressing problem.

**SLAUGHTER CATTLE EXPORTED FROM SOUTHERN
RHODESIA ACCORDING TO DESTINATION SINCE 1915.**
(Breeding stock are not included.)

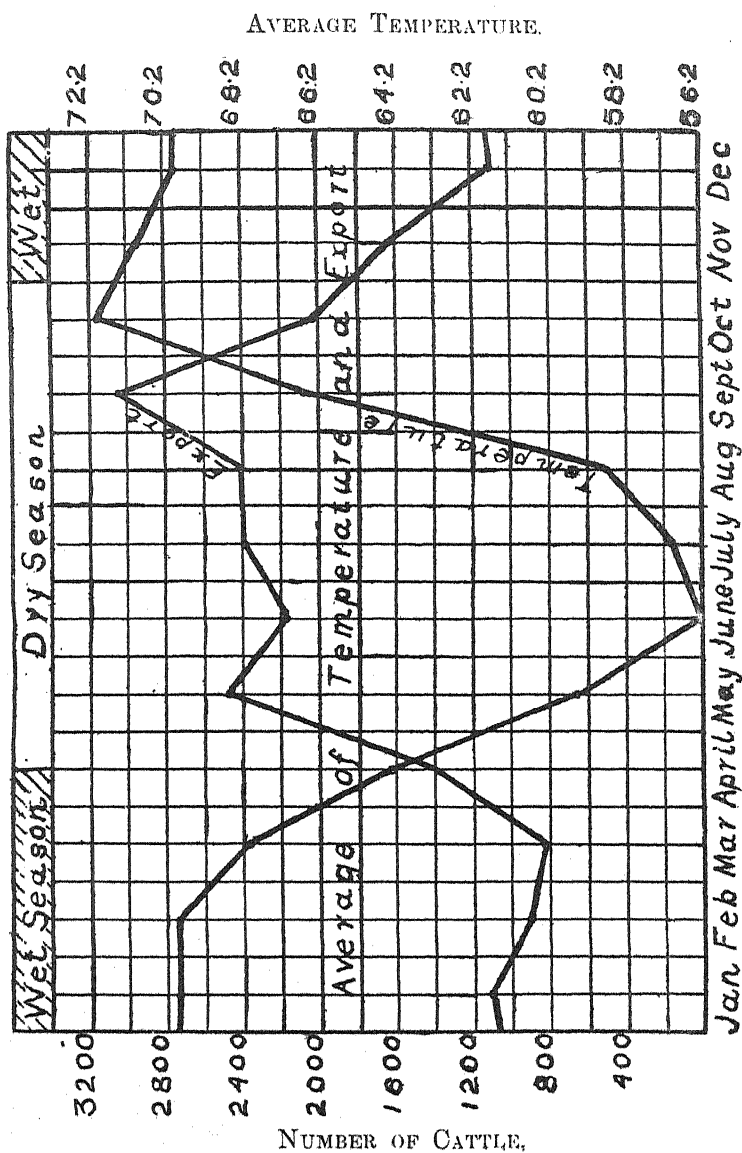
Year.	Total.	To Union of S. Africa.	To Port- uguese E. Africa.	To Northern Rhodesia.	To East Africa (War).	Per Canning Factory, Odzi.
1915 ...	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
1916 ...	12,722	12,722	Nil.	Nil.	Nil.	Nil.
1917 ...	13,180	13,180	Nil.	Nil.	Nil.	Nil.
1918 ...	22,703	12,134	1,181	Nil.	9,388	Nil.
1919 ...	24,625	22,735	1,059	300	Nil.	531
1920 ...	28,412	22,822	1,062	Nil.	Nil.	4,528
	101,642	83,593	3,302	300	9,388	5,059

The above table indicates the existing outlets for Rhodesian cattle. Prior to 1916 there was no regular traffic, only occasional odd lots. Despatch to the Union is limited by distance and prices rather than by supply. The demand from Portuguese East Africa has hitherto been restricted artificially, but the growing need, due to the rapid advance of that country, now renders expansion of this trade probable. Northern Rhodesia is closed by local policy; the East African trade was merely a war measure; the Canning Factory is temporarily inactive. The increase in the annually available supply of slaughter stock materially exceeds present markets.

In addition to slaughter stock there is a certain export in fresh and preserved meats from Rhodesia, as shown by the following Customs returns:—

1919	145,360 pounds.
1918	121,884 pounds.
1917	122,442 pounds.

It is interesting to compare with the figures for the exports of meat and cattle from Southern Rhodesia those for Madagascar, where for many years export of frozen beef and other meats and of beef extract.



EXPORT OF CATTLE—SEASONAL FLUCTUATION.

has been taking place. Madagascar lies largely within the same parallels of latitude as Rhodesia and about the same distance from European markets. The latest available figures are as follows:—

EXPORTS FROM MADAGASCAR.

	1918.	1919.	1920 to 30th September.
Cattle	2,178 head.	4,092 head.	8,177 head.
Frozen Beef ...	8,700,000 pounds.	17,425,000 pounds.	8,061,000 pounds.
Salted Beef ...	95,900 pounds.	11,400 pounds.	194,000 pounds.
Tinned Meats ..	10,813,900 pounds.	21,520,000 pounds.	11,195,000 pounds.
Meat Extracts ...	19,000 pounds.	30,000 pounds.	1,700 pounds.

The other exports of beef products comprised sausages, lard, edible fats, tallow, hides (raw, arsenicated and tanned), manes and tails, hair, horns, hoofs, bones, neatsfoot oil, gut and dried blood. The class of cattle in Madagascar is, we understand, inferior in size, maturity and in improvement by English breeds to that of Southern Rhodesia, although in numbers they are plentiful, the latest available figure being 6,784,000 head.

The seasonal character of the supply of cattle in Rhodesia has an important bearing on the operations of any freezing works which may be established. To this end the monthly exports during the past five years to all countries have been taken, and the cattle used by the Odzi Canning Factory included, since these are virtually for export also. The average for the whole year is 1,790 head monthly, and for each month is:—

January	1,107	May	2,468	September	3,032
February	888	June	2,169	October	2,029
March	825	July	2,388	November	1,617
April	1,393	August	2,405	December	1,088

This is also shown by a graph in the accompanying diagram.

For six consecutive months the supply is below the average and for six months above; for two months, February and March, it is materially below the rest, whilst the slack time from mid-November to mid-April, fortunately includes the holiday season, the wet weather and the hottest time of the year. Thus overhaul and extensions of premises and plant and vacation to staff fall during the period when the factories can be closed down or work reduced with a minimum of loss or inconvenience to stock owners and to the manufacturers alike.

From April onwards the supplies increase, remaining fairly steady from May to October, reaching a maximum in September, with a rapid reduction in November, which continues during the hot weather. There is thus one seasonal wave, and a tendency is apparent towards a steadier level from May to October and towards more uniform figures from December to April.

The mean monthly temperatures for the past five years are also given in the diagram and show that the supply varies inversely to the mean monthly temperatures, which are as follows:—

January	69.9	May	59.5	September	66.6
February	69.9	June	56.2	October	71.9
March	68.0	July	56.9	November	70.9
April	64.3	August	58.7	December	69.9

The mean annual temperature for Southern Rhodesia is 65.2 deg. F.

Export has to some extent no doubt been influenced by the fluctuations of price on the Rand, but not entirely so, since condition of the cattle must be the main consideration. Prices are consistently higher at Johannesburg from July to December, whereas our major export is from May to October, so that whilst benefitting by this circumstance we are not able to make our exports coincide precisely with high prices.

Chapter III.

CATTLE OF SOUTHERN RHODESIA.

Origin and Character of Native Cattle.—That prime necessity of all ranching countries, the presence on the spot of a suitable type of foundation stock upon which to build improved herds, is very fully met in Rhodesia. The native cattle of the country, to the number of about three-quarters of a million head, have been found to make an excellent foundation, being extremely hardy and immune, or nearly so, to many diseases of the tropics, qualities which are transmitted to a considerable extent to their graded descendants. Though small, the general type is not a bad one, and has frequently been admired by visiting cattlemen. Female breeding stock is easily obtainable at very low rates, heifers and cows being worth from 50s. to £7 according to size and quality. These cattle may be regarded as a fixed breed, the Mashona, probably, as an ancient one, and therefore pure-bred and sound prepotent bulls of European breeds are required to eliminate the more objectionable features, of which smallness is one of the most noticeable.

As one progresses from the south-western to the north-eastern border of the Territory a gradual, yet very material, change is observed in the character of the native cattle. In the fertile but somewhat dry plains bordering on the Kalahari Desert, which extends from the frontiers of Rhodesia to the Orange River, we find a large-framed ox capable of great endurance, growing into heavy weights, long horned, an obvious member of the group which has given rise to the famous Africander and its congeners the Damara, Bechuana, Ngami, Makalaka and Mangwato cattle. These features become less pronounced in the cattle of the Matabele, no doubt owing to admixture of other blood introduced as the result of cattle-lifting expeditions by that warrior tribe. The native cattle of Matabeleland, in their present form, date back to a period about eighty years ago, when Mzilikazi with his Zulus, having been driven out of what is now Natal

by Chaka, fled northwards with herds sadly depleted in their passages from Zululand through the depredations of other native tribes and the Dutch voortrekkers. A series of successful raids on the Dutch near Zeerust and on the Basutos, the Bechuanas, Barotses and Mashonas, ultimately restored the fugitive chief's losses, and the fusion of his original Zulu cattle with the captured herds resulted in the Matabele cattle of to-day. Thus the small and shapely cattle of the tropical north-east were combined with the large and hardy types of the arid south-west and the original Zulu stock, and these on the rich pastures of Matabeleland developed a distinctive type recognised as the Matabele cattle, still to be found unchanged amongst the more remote native chiefs. This is a medium-sized animal, possessed of remarkable powers of endurance, prolific, with rich but not much milk, excellent meat, and capable of becoming very fat on grass alone. Colour is, as might be expected in so composite a breed, not particularly regarded; a good beast is never a bad colour with the Matabele.

These Matabele cattle have since served as a valuable foundation on which the European farmers have, by the use of bulls of British breeds, built up their present excellent herds. Native owned cattle in contact with European herds have altered considerably by the infusion of other blood. The native is beginning to appreciate the advantages of early maturity and seeks to use improved though not pure-bred sires instead of the true native bull. That the natives' outlook has been gradually but sensibly modified and altered by the introduction of modern breeds and European methods is certain, but it is equally certain that they still, in their conservative fashion, hold fast to the simple principles of their forefathers. Natives are only now beginning to admit that there is a larger number of cattle in Matabeleland than there was in Lobengula's time. It would, however, seem doubtful whether, prior to the rinderpest visitation, there were more than 120,000 cattle in Matabeleland. It was generally estimated that there were 100,000. These were mostly "King's" or tribal cattle, but there were also some considerable herds, the property of private individuals. At the end of 1896, after rinderpest and rebellion had played their part, barely 5,000 cattle remained in Matabeleland. These in twenty-five years have increased to upwards of a quarter of a million. No longer are these native cattle in State ownership, as formerly, nor in the ownership of a few individuals. There are thousands of owners whose herds range from one or two head to five thousand and more. The six most wealthy natives own between them twenty-four thousand head. These are followed by perhaps ten, who possess a thousand apiece. This, although approximate, is a careful and conservative estimate. A very large proportion of these are the progeny of the original "King's" cattle allotted to the various communities and regiments of which the Matabele nation consisted. The history of native ownership, while of interest, does not come within the scope of these notes. The cattle of the big owners are split into innumerable small herds, and so serve the purpose of supplying milk to practically the whole nation, in very much the same manner as obtained in the days of Lobengula, with this exception, that the concentration of communities insisted upon by that chief is no longer observed, and consequently the cattle are kept in smaller herds. The

attitude of the native towards his cattle is perhaps not as fully understood as it should be. Cattle constitute his wealth (to begin with), his bank balance, the tangible proof of his prosperity. The medium through which the ancestral spirits are approached must be an ox—a black ox—which must be present throughout the ceremony until the spirits give a sign (the exercise of a certain natural function of the animal) that a favourable hearing has been accorded. The sacrifice of oxen is an important part of the funeral obsequies of a chief. Under good auspices is the marriage begun when the dowry paid is the traditional ten cattle. The reward of valour at the hands of royalty took the form of the presentation of an ox. Before the advent of wheeled vehicles the *inzomba* or pack-ox was their only means of transport. Herds of cattle grazing peacefully are symbolical of and identified with the power of the state.

Now the native, although conservative, is open to conviction. He is showing it in many ways. A "spirit-medium" ox can now be seen drawing a plough or a wagon, and will even find himself in a cattle truck bound for the South African Smithfield, when his bulk has attracted a tempting offer. (Of course he is at once replaced in his religious capacity by a young ox.) These isolated observations are only made as illustrative of the really profound change which is beginning. It is consistent with the foregoing estimate of the native cattle owner, whose standard of value is not money but cattle, to arrive at his unwillingness to sell. This he shares with all South African natives. Cattle raising is not a means to an end, but an end in itself. Only when compelled by necessity will they sell cattle. There are signs that this extreme attitude is being modified by economic pressure. The Chief Native Commissioner, in his annual report for 1920, estimates that during the year not less than 21,460 head of cattle were sold by natives to Europeans, of which a large proportion were oxen for the Johannesburg market.

In Mashonaland a smaller class of indigenous cattle generally is to be found, often very shapely, fleshy and compact, giving a neat blocky carcass, but of light weight, and sometimes rather weedy. These cattle, the origin of which is still unknown, but which were certainly a fixed type long before the Matabele reached Rhodesia, have also proved excellent for crossing purposes, the first generation showing great increase in size, yet retaining the hardiness and meritorious conformation of the dams. Much of the stock used by farmers to breed up from has originally been acquired from the Victoria district, and is named accordingly, but there is no real distinction between these and other indigenous cattle from other parts of Mashonaland. Owing to the demand for breeding stock, a considerable importation has taken place in the past of cattle from North-Eastern Rhodesia and Angoniland. These are generally of a still smaller type, some ridiculously small, and included among them have been a number of the Zebu race, lop-eared, hump-backed, fine boned little cattle, which, however, often gave very satisfactory results from crossing with European breeds. Various gradations seem to be found amongst these native cattle between the ordinary and the true Zebu type, as is only natural in the circumstances. On the light sandy soils a small class of cattle has evolved,

and in the hot and wetter regions, particularly as one approaches the low coastal regions of East Africa proper, the size of the cattle diminishes markedly, especially beyond the borders of Southern Rhodesia to the north and east.

Apart from the foundation stock derived from the indigenous cattle, large numbers of breeding heifers have from time to time been imported from the south, particularly from Kimberley, Queenstown and Bedford districts, and these being already largely grade stock, have of course saved several steps in the process of improvement, and are therefore more profitable. Some of our largest ranches, such as De Beers', have been built up on Cape stock, not from the native. Experience, however, has shown that losses amongst heifers imported from the south, especially from non-redwater areas, have been heavy during the process of acclimatisation, and it is doubtful whether their progeny, though larger in frame, are quite such good doers as the stock graded up from the native cows.

Breeds of Cattle Used.—The quality and the extent of improvement of Rhodesian cattle may in a measure be gauged from the numbers of pure animals of European breeds in the country, many, though not all, registered animals. The returns at 1st January, 1921, gave 8,468 such stock, of which 3,529 were bulls. In addition there are a large number of grade bulls of varying merit, the use of which, though to be deprecated, is at any rate an advance on the unimproved sire.

Bulls of British breeds have for some twenty years been coming into Rhodesia in steadily increasing numbers. As a consequence to-day there is a large proportion of grade cattle in the country, though it has not been found feasible to ascertain even approximately what the ratio is between native and improved cattle. The infusion of European blood amongst native owned cattle is very slight, although in some districts it is apparent. Some crossing with the Africander breed has been resorted to amongst them, but on the whole they may be classed as unimproved. Many European farmers own large numbers of native cows, but rarely if ever have native bulls, so that the progeny is at once improved. In the past, too, large numbers of partially improved heifers from the south have been introduced, and it is probably true to say that nearly half our cattle are no longer wholly native.

The degree of improvement is very varied, ranging from the first cross with a grade bull up to fourth and fifth crosses of a pure breed which now show little if any trace of the native blood. Third and fourth crosses are now plentiful, and higher grades are not uncommon. Considerable fluctuations in this respect occur in different districts according to their development.

Some complication in grading has arisen from the great variety of British breeds which have been introduced and the widespread practice of using several of these in succession. The result has been confusion, preventing the steady development of any pronounced type or uniformity in the herds such as is to be found in countries where breeders have adopted and consistently adhered to one or only a few breeds. No district can yet be said to have specialised in any one breed; indeed, adjoining farms very often use different bulls, and it is usual to find

many breeds being tried, chosen according to the fancy of the farmer rather than upon any manifest guiding principle. Thus in one particular locality containing leading ranchers and stud breeders, within a few miles are to be found both pedigree and grade herds of Shorthorns, Aberdeen-Angus, Devons, South Devons, Sussex, Friesland, Africander, Lincoln Red, with traces of Ayrshire and Red Polls, whilst Herefords happen not to be represented, though plentiful on similar veld not far away. The reason given for this state of things is a praiseworthy desire by each farmer to experiment and ascertain for himself the breed best suited to his farm, a process in the course of which he frequently produces a nondescript result at considerable cost in time and in bulls, valuable pedigree animals being wasted on mongrel stock of conglomerate origin, resulting in no proof of the superiority of any one breed.

The extent to which any European blood can be infused without the necessity for occasional reversion to a hardy type such as the native or the Africander has been the subject of much argument, and must remain so. Amongst the larger ranchers the opinion seems to be gaining ground that animals of most European breeds thrive on the veld, provided fair treatment is accorded, free range in enclosed camps or paddocks obviating the pernicious practice of kraaling every night, regular dipping, reasonable change of pasture and care in winter, with a modicum of hay and salt. Given a good constitution and fair treatment, there appears to be no inherent unsuitability in pure-bred animals which will prevent them living on the veld, provided they are not exposed to undue hardships, such as starvation, neglect of dipping, kraaling, irregularity in suckling, want of water, exposure to extremes of heat and cold; in fact failure of proper attention on the part of the farmer to his own interests and those of his cattle, for which it is not right to blame the country.

It would be wrong to infer from this that the use of all pure European breeds is recommended for any veld in Rhodesia. As yet farms generally are far from sufficiently developed or equipped to carry quick growing early maturing stock; there is still far from a sufficiency of fencing and other requisites, so that stock less productive of flesh or milk, but better able to withstand adverse conditions, is generally indicated. Moreover, use must be made of such stock as we have, and that consists for the main part of the native and native cross supplemented by Africander and nondescript cows imported from the south representing a wide range of grading. It must necessarily be some time before these can be graded up to a high level, and such improvement must be accompanied by development artificially of the natural resources of each ranch or farm.

The success which has been achieved with pure, even imported, animals properly cared for running on the veld, is patent for anyone to see, and conveys the assurance that in time cattle of high grade, amounting for practical purposes to pure British breeds, will be maintained over a very large part of the country.

It is only natural that, as in all other cattle countries, including England, the most highly evolved or most refined breeds should be located on the best land available, while for ranching, as opposed to farming,

where large numbers of animals are run over medium veld with the minimum of expense and handling, the hardier and less artificial breeds would be selected. A breed giving excellent results when run on an agricultural farm, in small numbers, subjected to individual attention, and with stabling and artificial feeding always available, might quite well be a hopeless failure under true ranching conditions. Rhodesia is primarily a grazing country, and for this reason alone Rhodesian ranchers should select one of the true grazing breeds. For many years to come, the great bulk of our cattle must be sold in prime condition off the grass, and therefore every cattle owner, apart from the favoured few in the best agricultural districts where the feeding of cattle is already an established industry, must decide in his own mind, and base the decision on his knowledge of his own veld, what is the best breed for his farm. Size, though useful, is not everything, and it is not every district or type of grass that will produce large cattle in saleable condition. Again certain kinds of grazing which may only carry, say, three head of the larger breeds per 60 acres, might, if stocked with one of the smaller and more active and hardy breeds, carry four head to the same acreage or even more, and in new countries especially, the contention that it is wisest to carry one's eggs in as many baskets as possible, has a good deal to recommend it.

The definition of a "grazing breed" may be stated as "one whose stud bulls and more highly bred females retain their sexual vigour and general health under ranch, *i.e.*, grazing conditions"; that is to say live and thrive without continuous stabling and artificial feeding, both of which are practically impossible on a really large scale if satisfactory financial results are to be obtained. It has been found in practice extending over a number of years, that it is quite possible, provided the right breed or breeds be selected, for South African pure-bred bulls to run on the veld in service, day and night, winter and summer, after they have reached the age of two years and upwards, without any shelter other than that of the native trees, and without feed other than grass. But under such conditions constitution must rank before all other points, and the number of bulls should range from 3 to 4 per cent. of the cows. Water must be easily available and the grazing good average, in paddocks not exceeding 4,000 acres in extent. It has, at any rate in some cases, been found more profitable to increase the number of bulls to the above limit, if by doing so expensive stables and artificial feeding can be almost entirely dispensed with, than to keep a few somewhat delicate, highly bred and highly fed bulls standing in a stable, and going to all the extra expense and trouble of bringing the females up for service. Of course the condition of the grazing bulls has to be closely studied, and as soon as good hardy active condition looks like giving way to one denoting the approach of weakness or poverty, any such animals must be drafted out and fed, and for preference steered and sold. Constitution and ability to live and thrive on the natural grasses of the country would appear to be the most valuable features in Rhodesian ranching cattle, judging from the purely financial standpoint.

Considerable difference of opinion exists as to how far it is possible or desirable to grade up, so much depending to-day on the class of grazing available, the suitability of the breed chosen to the environ-

ment, and the extent of the ranching operations. Besides this, the country is still too young for anyone to speak with entire confidence from actual experience. In a number of herds, seven-eighths-bred heifers are now being moved into the breeding paddocks, and are so far showing their ability to hold their own under natural conditions and in average seasons. Most breeders of experience advocate a strong admixture of Africander blood, and can give very sound reasons, based on actual results, for this opinion. One has to breed with an eye to the worst possible season one may get, not to the best, or even good average. It is also sounder practice to have one's grazing too good for one's stock, than to have one's stock too good for one's grazing. It is unreasonable to expect colonial stock, however well bred, to mature as rapidly as is the rule in Europe, where the cattle live under conditions of climate, food and handling entirely different from what they have to put up with abroad, and it may be confidently stated that except in the case of artificially fed steers our grass-fed grade bullocks will not reach profitable maturity under from four to five years, and much later in the case of purely native stock, which are not supposed to reach their maximum weight much under nine years. Heifers of all breeds can safely be allowed to calve at three years, provided they have experienced no severe set-backs.

It has so far been found impossible to get reliable figures showing the actual average cost per head of running cattle in this country. It is estimated, however, from sets of certain returns covering a period of years that the cost of producing a grass-fed bullock on an established ranch of average size runs to about £1 for every year of age, so that a five-year-old bullock selling for £12 would show a profit of £7, or say at the rate of 28 per cent. per annum.

The following is a list of the leading ranches in the country, indicating the breeds favoured by each. Perhaps a few may have been overlooked, as it is not possible to prepare the list from personal knowledge of every case, but the list is sufficiently comprehensive to indicate the relative popularity and the wide distribution of the breeds in question. Only ranchers using the breed are mentioned, not stud breeders.

Shorthorn.—Messrs. H. P. Fynn, Bembesi; Shangani Estates, C. W. Adams, J. M. Ewing and H. H. Williams, Bubi; H. S. Bawden, W. B. Walker, R. O. Carruthers and De Beers' Ranching Co., Insiza; Dechow & Tweedale, Nyamandhlovu; A. G. Hay, Umzingwane; E. T. Kenny, Gutu; Tokwe Ranching Co., Selukwe; W. B. Richards and J. Halliday, Victoria; B.S.A. Co., Nuanetsi Ranch, Chibi; J. G. B. Bernard and C. C. Macarthur, Salisbury; M. Macaulay and G. Peake, Lomagundi; E. Scott and Rhodesia Lands, Ltd., Mazoe; Rhodes Estate, Inyanga; B. D. Barry and W. M. Longden, Melsetter; B.S.A. Co.'s Premier Estate, Umtali; G. C. Woodforde, Gatooma.

Devon.—Messrs. Gwynn's Rhodesia Estates, Ltd., Nyamandhlovu; Rhodesia, Limited, G. Stodart and A. G. Hadingham, Insiza; R. Aserman, Bulawayo; Mashonaland Agency, Bubi; A. Herud, Selukwe; J. Struthers, Victoria; Deweras Ranching Co., Hartley; Coles, Mashonaland Agency and East Clare Estates, Gwelo; Rhodes Estate,

Inyanga; Farm Lands of Rhodesia, Umtali; Horton & Williams, Nyamandhlovu; W. White, Figtree; B.S.A. Co., Rhodesdale; H. Leith, Antelope; A. E. Yorke, Belingwe.

Herefords.—Messrs. C. S. Jobling, G. Mitchell, Beamish Bros. and J. Moore, Nyamandhlovu; Cooper & Nephews, R. Granger and F. Rayner, Bulalima; J. M. Ewing, Bubi; P. Forrestall, J. H. Williams and L. R. Hartley, Victoria; Tokwe Ranching Co., Selukwe; B.S.A. Co., Rhodesdale Ranch, Hartley; E. T. Kenny, Gutu; Willoughby's, Ltd., Central Estates, Chilimanzi; Wiltshire Estate, Charter; Lendy Estates and Land Settlement Estate, Marandellas; Indindu Ranch, Liebig's, Gwanda; P. H. Gresson, Salisbury; Thorneycreek Ranching Co., Lomagundi; Farm Lands of Rhodesia, Umtali.

Aberdeen Angus.—Messrs. J. R. Stewart, Insiza; L. G. Robinson, Umzingwane; H. S. Henderson, V.C., and Liebig's, Gwanda; Brocklehurst, Charter; H. H. Field, Gwelo; G. A. Dobbin and Rhodesia Lands, Ltd., Mazoe; D. Black, Salisbury.

Africans.—Messrs. P. Fletcher, Bulawayo; H. P. Fynn, Bem-besi; Mashonaland Agency and H. S. Bawden, Insiza; Liebig's, Gwanda; W. E. Biddulph, Selukwe; W. B. Colling, Mazoe.

South Devon.—Messrs. the Anglo-French Matabele Co. and Trevelloe Estate, Insiza; L. O'Keefe, Bubi; A. Strickland, Umtali.

Sussex.—Messrs. L. Glanfield, Salisbury; Liebig's, Gwanda; De Beers; Insiza; Exploring Lands and Minerals, Ltd., Charter; G. A. Dobbin and Sir Thomas Cullinan, Mazoe.

Of all European breeds the Shorthorn, including the Lincoln Red, is pre-eminent, the pure breeds numbering, according to statistical returns at 1st January, 1921, 1,837, that is, over one-fifth of the whole. A high degree of perfection has been attained with Shorthorns bred in Rhodesia, due to the superior class of animal imported, and this is no doubt a cause of their popularity. In certain other breeds, unfortunately, Rhodesia has been used as a dumping ground, with consequences natural but regrettable to their reputation. Actual breeders of Shorthorn cattle in Southern Rhodesia, that is farmers owning both bulls and females described as pure, though not necessarily pedigreed, number no fewer than 58; the cattle consist of 1,011 females and 520 bulls. Apart from this there are other farmers using 306 pure Shorthorn bulls on native or grade cows. The stud breeders of Shorthorns are found all over the country, no one district being pre-eminent; a score of breeders operate on a fairly large scale, the rest own just a few head of stud stock, averaging four females each, whilst of the large number of farmers who use the Shorthorn bull it will be observed from the above figures that on an average they have about two each. There is, of course, a very large number of grade Shorthorn bulls also in use, some of which are highly bred and the influence of the breed is to be seen very clearly from one end of Rhodesia to the other.

The stud breeders of Africans appear to rank high in numbers of cattle, but this is probably due to a somewhat loose interpretation

of the term "pure bred" both as regards bulls and cows. The return of 2,770 Africander cattle is divided amongst 23 stud breeders, 47 stock-owners using them only for grading purposes. These high figures are not borne out by a corresponding prevalence of Africander stock, pure or mixed, on our farms, in our markets, or at our shows, and must therefore be accepted with reserve. Undoubtedly, much of this blood has been brought into Rhodesia with benefit, but the number of pure-bred Africanders certainly falls short of the above figures, which probably embrace a considerable amount of grade stock of Africander type.

Next in numbers to Shorthorns amongst European breeds we find the Devon—the true or North Devon. The Devon claims some eleven breeders, and the cattle number 513 females and 275 bulls, the balance of the 947 head being bulls in use in herds for grading up purposes, so that the influence of this breed on the cattle of Southern Rhodesia is already pronounced. It is claimed that the breed does well on less fertile land; after all, the best soil is always the least plentiful, so that the scope of this breed is wider than that of others demanding the best possible conditions. If lighter and less rapidly maturing than some, yet the Devon can be fattened and finished on veld where heavier breeds not only fail to make flesh, but even become stunted. The Devon has also shown itself adapted for rough country, although it responds well to favourable conditions. The breed is particularly strongly represented in the midlands and western districts, and is less frequently met with on the northern and eastern side of the Territory, though so far as the nature of the country is concerned, there seems no good reason for this distribution, which will no doubt be modified as bulls locally bred become more readily obtainable. Besides the numerous individuals who possess single bulls, there are a number of ranches with from ten to twenty and even more Devon bulls.

The South Devon is to be clearly distinguished from the breed of similar name. Though less numerous, mustering only 285 head, and less well known, this breed has in a short space of time won for itself a recognised position throughout the sub-continent, and is to-day firmly established. There are ten stud breeders of South Devons in the country, owning amongst them 104 pure-bred bulls and 181 females, so that a good supply of Rhodesian-bred stock of this breed may be looked for in the early future. Users of the breed having bulls but no pure-bred cows number 23, distributed remarkably evenly, so that a fair test is being made of the breed in the country.

The information collected indicates that 26 breeders of pure Hereford stock possess amongst them 464 females and 450 bulls, whilst 76 farmers use Hereford bulls on mixed stock. This vouches for the popularity of the breed, which is found in every part of the country, though most of the pure-bred stock is raised in the vicinity of Bulawayo. The breed is found to do well and to impress its merits to a very marked degree on foundation stock of native or intermediate origin. At our shows Herefords have always distinguished themselves, and their influence is being appreciated in the stockyards as well.

The Aberdeen-Angus breed has of late come into prominence. The total number of pure animals is given as 476, of which 227 are females.

owned by twelve breeders, whilst 34 owners of bulls only are recorded. The breed is strongly represented in the districts of Salisbury, Mazoe and Lomagundi, though it is also rather widely distributed elsewhere. Several prominent breeders are located in Matabeleland, and most of the pedigreed stock is in that province.

The Sussex breed boasts five breeders, owning amongst them 141 females and 189 bulls, whilst 13 supporters own bulls only. These latter seem to be located more in Mashonaland than in Matabeleland, though the breeders are evenly distributed. It is noticeable that certain of the largest ranches in the country have gone in for this breed and are rearing their own bulls, which accounts for their comparative rarity at our shows and markets.

Considering the scope for dairying in connection with mixed farming and small holdings, it is remarkable that the Friesland breed represents only 9.4 per cent. of the European breeds in the country. Friesland females, reputed pure, though they are by no means all registered in the stud book, number 556, and are owned by 25 breeders scattered over all parts of the country, one-third holding large herds, the rest only a few individual animals. These breeders account for 148 bulls, whilst 80 other supporters of the breed owning only bulls give a total for the Friesland breed of 804 head. The Friesland is undoubtedly the principal milk breed in the country, and, though not as popular as it is in the south, still takes an important place. The cross-bred Friesland stock is numerous. Naturally the breed is held by the dairyman and mixed farmer, and not by the rancher.

The Ayrshire breed, as is only to be expected from an essentially dairy type, is somewhat scarce. It numbers only 48 pure-bred females held by four owners, and 25 bulls, which are domiciled exclusively in Mashonaland, except for one specimen in Matabeleland. Recent purchases not yet recorded in the return will no doubt give a fillip to this eminently desirable dairy breed.

To come to the less popular breeds, only four breeders of Red Polls are recorded and six users of bulls, accounting for a total of 53 animals. Only one breeder of Galloways is known, and one owner of Jerseys.

It is a generally recognised fact that the most prominent breeders of stud stock are to be found in Matabeleland, and at the agricultural shows the bulk of the prize-winners are usually from that province. Certainly the largest and best known pure herds are there. It will come as a surprise to many therefore to learn that of the 178 breeders of stud cattle in Southern Rhodesia 105 hail from Mashonaland and 73 from the sister province. Apparently a number of farmers there possess only a few head of pure-bred stock, and do not exhibit them or have only recently entered the field as breeders. This unlooked for result of the examination of the returns indicates a probability of interesting developments in the show yards in the early future.

Chapter IV.

REARING AND MANAGEMENT.

Methods of Management.—The principal method of handling cattle throughout Rhodesia is, with slight variations, the one that has been practised for all time by the natives of the country, viz., herding by day and kraaling at night. This system, which has been adopted as the best for the conditions prevailing, has quite a lot in its favour, but has its drawbacks, amongst the chief of which are that the cattle have to eat and drink where and when the herd boy thinks fit, and go without food or water if he so wills it. It has been proved by experience that ranch cattle running at large in a suitably fenced in enclosure, at liberty to eat and drink when they like, thrive very much better than kraaled animals. Both these systems are adopted by ranchers, fencing being employed to such an extent as circumstances permit. The bullocks are sold direct off the grass to the slaughter house. With owners possessing smaller estates and fewer cattle further variations in the above mentioned systems occur. Every endeavour is made to allow cattle free range inside wire fences, supplemented by hand feeding hay and silage during the winter months of the year in kraals, stables or sheds, the object being to keep the cattle in a growing and thriving condition and avoid any chance of a set-back, and in the case of milking cattle, to keep up the milk supply. In the case of milking herds and fattening bullocks, crops are grown to feed the animals, maize being the principal feed preserved in the form of silage; majordas and pumpkins are also extensively used, although old customs are difficult to eradicate; the knowledge that cattle can exist, and in most seasons do exist, very well on the natural grass of the country, is fairly speedily being replaced by the knowledge that it pays better to supplement this grazing in the winter by food saved from the season of plenty in the summer time. The fattening of bullocks in yards is gradually finding favour with the smaller cattle owner. At one time it was the custom of the farmer to work his oxen for a few years before selling them for slaughter; now several men never work an ox of their own breeding, but buy native animals for this purpose, their own being sold fat either straight off the grass or put up in yards and fattened for the butcher. As the country becomes more fully stocked the practice of selling young steers (tollies) for running on for another season is gaining ground, as is also, to a small extent, the buying of store cattle for fattening purposes.

In regard to cattle management, while valuable hints may be borrowed from other cattle countries many of the problems here are peculiar to Rhodesia, and any attempt to graft outside systems in their entirety on the ranches here is doomed to failure. Essential points are ability to handle the native labour; to deal with stock diseases; to select suitable country and a type of animal best calculated to "do" on the land selected. Properly handled, the native, who has a wonderful faculty of observation, especially where cattle are concerned, is an invaluable asset. He can cover long distances on foot, and little that goes on either in the bush or in the open escapes his notice. The

management of cattle in Rhodesia hinges upon the regular weekly dipping, obligatory by law and now recognised as being the central and most important operation on every ranch, the one duty on which everything else hangs and to which everything must be subservient. Nothing but a spell of quite unsuitable weather should interfere with it. Not only is tick-borne disease suppressed and prevented, but other ailments as well which are associated with these or which are aggravated thereby, such as diarrhoea in calves, anæmia, also skin diseases and fly troubles. In addition this regular round up affords the owner the opportunity of seeing each animal individually and of taking an accurate count.

All experienced cattle men advocate the paddock system as opposed to herding and kraaling, principally because cattle run in large paddocks select their own time for grazing, and are not at the mercy of lazy herd boys. Moreover, old kraals are hot-beds of disease, and results show that paddocked cattle are superior in condition, and the death rate is consistently lower than in the case of cattle herded by day and kraaled at night. There are difficulties in the paddock system. The cattle are wild and not so easily handled; careless travellers leave gates on roads open, and it is not always possible to ensure that all the cattle in a 4,000 acre lot are collected for the weekly dipping. The advantages, however, far outweigh the disadvantages, and whereas under the herding system no mob should exceed 150, it is possible to run 1,200 or 1,400 head in a single 4,000 acre camp. The constant or frequent attendance of native herd boys amongst the cattle is necessary in a country where half the mortality is attributable to vermin, lion, leopard, wild dog and crocodile.

Fattening Methods.—The fattening of cattle, that is, the conversion of store stock into primes, as understood by the butcher, is possible over the larger part of Rhodesia on the grass alone during the summer months, resulting in a large supply in excess of present requirements during the months of January or February to August, although in the low bush veld cattle will be found in good condition as late as November. The artificial feeding of cattle either in the fattening pen or kraal, or at troughs and mangers in the field, is beginning to be practised, and though more costly than mere grazing, has yet been shown to be practicable, especially for arable or mixed farms. This process is not, however, very attractive at present, owing to the long journey and the uncertainties of the remote markets, and cannot be generally adopted until a local outlet for such stall fed stock is assured through the medium of a freezing works, which would thereby be supplied with the highest class of meat which the country produces from about August till December, when good grass fed stock are not procurable to the same extent as at other times.

Some interesting accounts of experiments in fattening cattle of suitable age taken up off the veld have been collected and are given below. For some years past the Agricultural Department has carried out experiments in the fattening of store beasts at the Gwebi experiment farm. The earlier experiments established some facts which later and more extended trials have confirmed. They are these:—It is not profitable to artificially feed unimproved native stock, but only grade

beasts, and the better the quality the more successful the process; it is not profitable to stall feed in the summer months when veld is good and abundant; complete stalling is better than grazing by day and stall feeding at night. All that is necessary to turn out a prime beast can be grown on the average farm, and the grazier can please himself as to whether he forces on the process in the quickest possible time, or uses inferior grades of produce and so makes the process rather longer, though the fattening period should in no case exceed five months.

In the year 1919 ten animals were treated. The direct increase in weight during the fattening period was 2,655 lbs. net, and while the original value of the beasts when shut up was put at £8 per head by competent judges, the selling price in Rhodesia was £17 10s. per head. These beasts were subsequently sent to Johannesburg, where they realised 36s. per 100 lbs. live weight. They killed 60 per cent. of their live weight, and realised the top market price of 60s. per 100 lbs. dead weight, while the butchers reported the quality of the beef as always certain to command top market prices. The latest experiments at the Gwebi farm in 1920 showed that each animal fed gained in 18 weeks 276 lbs. The average dressed weight of the carcasses was 732 lbs., and the quality of the meat first class. Thirteen beasts of the same class and age, but veld fed, were forwarded with the stall fed oxen to Johannesburg. They suffered from the journey much more than the stall fed beasts, and only realised £8 18s. 9d. per head, a net price of £5 10s. 6d. per head, as against a clear £22 4s. 10d. for the stall fed animals. These latter dressed 60.5 per cent. of their live weight, a striking proof of the degree of excellence to which the feeding had brought them and the capacity of the cattle to benefit by the feeding.

The artificial feeding of cattle is gaining ground, and the following notes from Matabeleland and Mashonaland indicate the views of successful feeders and exhibitors of fat stock on this question.

The rainfall throughout the greater part of Matabeleland is much less than that occurring in the eastern parts of the Territory. This fact may have some bearing on the resulting native herbage, which is comparatively short, fine in texture and sweet. When the rains are over the grass cures naturally on its stems, and through the long dry season—though apparently dry and bleached—maintains not only its palatability, but, in a surprising degree, its feeding qualities. Cases of overstocking are very rare; in fact the country as a whole is much understocked. Generally speaking, matured oxen will remain fat on the veld alone for at least nine months in the year, and naturally it is during the remaining three months that prime beef is usually at a premium. Few breeders make any provision for winter feeding beyond some veld hay, generally cut too late in the season to be of high quality. The practice of making silage has not been adopted by the generality of breeders, though it is being adopted by an increasing number each year.

It would seem well worth while to maintain and even improve the normal good condition of steers during the three months referred to, when most cattle lose a great deal of flesh. This may be done by supplementary or stall feeding, in yards, sheds or small paddocks. It is especially worth while, since the necessary foodstuffs may readily be made available at small cost.

In this country the basis of a ration for fattening steers will naturally consist of mealies and silage. These may be easily and cheaply produced on almost any farm. Satisfactory results may be obtained from these feeds, supplemented by well made veld hay; but bigger and more economical gains may be expected if the ration is balanced by ground nuts, velvet beans or cow peas, and the fodder from these plants. One at least of them may be grown on any farm. Provided the steer is put up to feed in good veld condition, a feeding period of from 100 to 120 days will be sufficient to make him prime beef. During this time each steer will consume from five to six bags of mealies, about one ton of silage and 200 to 300 lbs. of bean or monkey nut meal; so that the cost may be roughly estimated in advance. Having regard to the number of pure-bred beef bulls now in the country, it is clear that a large and increasing number of steers of the right type is now available for feeding, and it is very much to be desired that a constantly increasing number of breeders or farmers should feed even a few steers each every season. The practice has been found profitable in all cattle countries, and there can be little doubt that it will become an important branch of the farmers' business here. For several years the writer has fed from 10 to 20 steers each season. These animals when brought off the veld were of an average value of £10 per head. The average cost of feeding was £7 10s. per head. When sold fat the steers made from £20 to £32 10s. per head, but that was in the days of higher prices than obtain to-day. No cake was purchased, all feeding stuffs being grown on the farm.

It is probable that the business of fattening cattle will develop rapidly with mealies at a normal price. Another incentive will be created by a proper realisation of the value of the resulting manure and the fact that, sooner or later, the mealie grower will find that he cannot do without it.

The following notes represent the experience of a prominent farmer in Mashonaland, who favours the Shorthorn grade steer on account of his size, proportion of hind quarter to fore, and because if grown on a farm with good pasture and treated fairly, he is a heavier animal than any other grade or breed at the same age. The steers should be taken out of the herd for feeding when they have cut their four teeth, i.e., $2\frac{1}{2}$ years. At that age they have done most of their growing, and will respond at once to feeding. Feeding at a younger age is not economical, as the beasts grow instead of putting on flesh. The steers should be put in the pens about the beginning of April, or, if the grass has gone off, a little earlier, but to take them off good green pasture with a view to their feeding straight away is a mistake, as they will only fret, and probably a month's time and feed will be wasted. Three months should fatten animals suitable for prime beef, provided that they were in good condition when taken off the grass, but to "top" them off for shows a longer time is necessary. A good grade, well-grown Shorthorn steer, with three months' stall feeding, should weigh 700 lbs. at three years old, or when he has just cut his third pair of permanent incisors. For ordinary commercial feeding a ration as under is sufficient:—

10 lbs. coarse ground mealie meal;
25 lbs. pumpkins sliced and mixed with meal;
25 lbs. silage (mealie) or same quantity bean hay;
as much good fresh hay as they will eat stacked in their pen or yard. There is no need to soften the meal if mixed with pumpkins.

Fed on the above ration, which is easily grown on an agricultural farm, the cattle could be fed at a cost of 1s. per head per diem. Working on a basis of a steer worth £10 on the veld, three months' feed should bring him to a weight of, say, 700 at 50s. per 100 (a low estimate for stall-fed cattle), which, after deducting £4 10s. for three months' feeding, leaves a profit of £3.

The method to pursue when first taking the steers out of the herd is to put not more than five or six together in an open yard, 20 to 25 yards square, untied for a month or a little longer. When they have become thoroughly used to their surroundings, catch them and tie them up. For five head an 18 to 20 foot feeding trough is quite enough. Water should be within easy reach, not more than 500 yards away from the feeding pens, which should be fenced off under large shady trees, or if these are not available, a rough thatched shelter should be erected for shade. As the fattening process is in hand during the dry season, it is hardly necessary to put up rain shelters.

Yet another experienced feeder using grade Shorthorn and South Devon steers of three to three-and-a-half years old, takes them off the veld early in August, and at once ties them up securely in open sheds, where they take about three weeks to settle down to their changed conditions. They are taken out to a small paddock twice a week for a change and exercise for three hours at a time, and are regularly dipped. The first two weeks they are fed on silage and hay, then they get a little meal, and as time goes on silage and meal are increased accordingly as each animal is able to digest it. The fattening takes about sixteen weeks. Some can be finished at fourteen weeks, while others again will take eighteen weeks; some breeds take longer than others. There is no waste, feeding must be done regularly, and it must be seen that each animal relishes what it gets. The record of the most recent lot dealt with is interesting. On the veld before feeding they were valued at £12. On the 23rd November they were taken to Gwelo by train and shown, and nine sold at Messrs. Shiff & Jacobson's show and sale on 25th November. Eight were held over and shown and sold at Mr. A. E. White's sale on 2nd December. The cost of feeding 17 oxen 111 days, with all expenses until they were sold at Gwelo, was £157 12s., and the returns were as follows:—

Seventeen oxen sold for £495; value of manure £20; £515.

It must be recollected that these prices were secured at Christmas fairs and for prime stall-fed cattle.

Trading Methods.—The present cattle trade in Southern Rhodesia is mainly conducted through the municipal stockyards of Bulawayo, Gwelo and Salisbury, where a number of firms of auctioneers dispose of stock consigned to them at periodic sales. Occasional sales are also conducted at other centres, such as Umtali, Bindura, Marandellas, Hartley, Gatooma, Victoria, and under the control of the local farmers' associations very successfully at Plumtree, Shangani, Rusape and Sinoia. Peripatetic dealers secure a certain number privately on farms or by trading from natives on reserves. Those most conversant with the markets state that weights and quality are alike improving.

Mashonaland is recognised to be for the most part too far for direct transmission of cattle to Johannesburg, though a considerable amount of fat stock is despatched, resting twenty-four hours at Bulawayo. Markets are mainly for local consumption, the mines taking the inferior grades for compound purposes. The question of an outlet is more felt in the eastern and northern portions of Rhodesia than in the south and west, although the entire country, and adjoining regions too, would benefit by the establishment of local centres to which fat stock could be sent and killed soon after leaving their pastures, to the advantage alike of producer and consumer.

The value of slaughter stock in Matabeleland is controlled by the selling price in Johannesburg; buyers are mostly also dealers, and in buying try to arrange so that they can market part of their purchases in Johannesburg at a profit, retaining for local use what can be most profitably sold here.

Most of the business is done on credit, auctioneers paying sellers cash and taking 30, 60 and 90 day bills, thus enabling dealers to dispose of their purchases before they are called upon to pay. This is an unhealthy and dangerous system, and in times like the present, when the banks are unable to afford overdraft facilities, the breeders run considerable risk of losing money or having to wait too long for it. As an example: At the time of writing the banks are calling upon farmers in the Union to reduce their overdrafts, and in order to comply, live stock is being sent to market in such large quantities that for some time the Johannesburg market has been over-supplied, causing a rapid decline in prices. Johannesburg market agents are obliged in consequence to advise Rhodesian sellers not to forward any stock; this caused a serious drop in local values, especially in the value of medium and poor quality meat; even prime beef has been affected, but not to the same extent as the poorer qualities, which are at times unsaleable. At times such as that instanced above, it is the most distant source of supply, viz., Rhodesian, which suffers first and most.

Mortality.—The death rate under natural conditions on the farm, as contrasted with other countries, is low. From information collected from all parts of the country, especially for the purposes of this report, the majority of ranches give a mortality for adult stock of 2 to 5 per cent., 3 or 4 per cent. being usual. In several reliable and well authenticated instances on specially well conducted ranches this figure falls to 1 or 1½. Anything over 6 per cent. is exceptional and demands investigation. The mortality of calves under twelve months old is

somewhat higher than for adult cattle, and varies considerably, from 3 to 8 per cent. being the rule. Figures are returned as low as 1 per cent. and as high as 10 per cent., very rarely more. Fluctuations all the way from .5 up to 17 per cent. are recorded, but these extremes are so exceptional that they may be disregarded. The figure is found to vary with the attention given and with the management, rather than with locality, soil, climate or other natural causes. It depends also upon the class of cattle kept. Where kraaling is still practised the mortality, especially of calves, is relatively high. Less than half the total deaths are due to disease, of which at present quarter-evil takes the heaviest toll. Violent deaths, due to accident, poverty and so on, are less where cattle run day and night in fenced enclosures than when run on unfenced land and kraaled at night. More than half of all deaths are attributed to wild animals, lions, leopards and snakes, but chiefly to the depredations of wild dogs.

As indicative of what can actually be accomplished on a large ranch and with figures reliably audited, we publish with permission the following mortality returns for three years from the De Beers Ranch, Shangani:—

Mortality.	Actual numbers for the year ending 30th January.						Average percent- age of deaths over 3 years.
	1920.		1919.		1918.		
	Cattle.	Deaths.	Cattle.	Deaths.	Cattle.	Deaths.	
Bulls (S. African bred)	155	5	193	19	433	1	3.2
Breeding Cows	5,017	36	5,241	32	3,292	26	69
Oxen	2,033	24	1,958	4	1,239	4	61
Native Oxen (draught)	106	Nil.	83	Nil	138	6	1.83
Young Stock	3,922	52	2,590	63	3,713	49	1.6
Calves	1,576	99	2,280	88	949	28	4.47
Averaging							2.07

The company attribute the low death rate to the system of regular dipping, "the efficiency of which is clearly demonstrated," they state, "by the fact that owing to this it is not now necessary to immunise our imported cattle against tick-borne disease."

The following well authenticated instances in large herds with properly kept returns are interesting:—

	Number of cattle.	Mortality, all ages, per cent.
A	2,000	2
B	1,818	3.4
C	1,747	5.5
D	1,900	5
E	21,079	4.08
F	5,823	6.34
G	6,423	1.99
H (7 years)	10,000	3.89
I (8 years)	1,040	4.4
J	5,198	2.38

General Health Conditions.—Compared with conditions in other cattle raising countries the health of cattle in Rhodesia is remarkably good. It is found that Rhodesia is very free from those serious diseases which take heavy toll of the cattle population of the world, while the minor ailments of cattle, such as colds, pneumonia, indigestion, foul in the foot and such complaints prevalent in other lands, are practically non-existent. The only disease that destroys an appreciable number of cattle is quarter-evil or black-leg. This disease appeared in the country at the end of 1916, and, owing to the susceptibility of the cattle and ignorance of many of their owners in the preventive treatment of the disease, more cattle were lost than should have been the case, but, really, the death rate has been very small. No statistics are available, but it is safe to say the loss has been less than 1 per cent., probably less than a third of 1 per cent. Now that the disease and its preventive treatment are better known, it can, as in most other countries, be regarded as not worth serious consideration. In Rhodesia it causes more deaths, few as they are, than any other disease, and there is a preventive treatment. Anthrax, which plays sad havoc in many countries, exists only in one portion of Rhodesia, and during the last twenty-five years of its history less than 250 deaths from anthrax have been recorded in cattle, and no cases in other animals. Actinomycosis, fluke and worms are rare, and stiff sickness is a transient indisposition only.

African Coast Fever causes more alarm than injury to the cattle industry, and the cattle owners affected by an outbreak are more inconvenienced by the quarantine restrictions imposed than by the actual loss of animals from the disease. The report of the Committee of Enquiry into African Coast Fever, 1920, gives a schedule showing that from 1906 to 1919 inclusive the mortality from this disease for the whole of the country only amounted to 7,001, or 500 head per annum, a very small loss when it is compared to the number of cattle in the country, and when it is remembered that methods of preventing its occurrence were not well known or practised during the earlier years. At the present time there is only one centre in the country where deaths from this disease are occurring, and with a fully-manned Veterinary Department to handle it, with the cattle owners alive to the possibility of preventing it from gaining an entrance to their herds, and by practising regular dipping, it is hoped the day is not far distant when this disease will be entirely eradicated from the country.

Contagious abortion occurs, but happily successful means of diagnosis and treatment are available.

Tuberculosis was not known to exist in Rhodesian cattle until the export of cattle to the Johannesburg market in 1916, when it was found to be present in a small number of the animals slaughtered. The origin has not been determined, but it is thought possible that the cases were contracted from human beings suffering from the disease. Only two outbreaks of tuberculosis have been recorded in herds. In both instances the disease was directly traceable to imported animals. In one case the disease was eradicated some years back by the tuberculin test, and has not reappeared; in the other the process of eradication has just been completed.

Redwater and gall-sickness also cause a certain amount of loss, principally in imported cattle, but preventive inoculation for these diseases is being yearly improved upon in the Government Veterinary Bacteriological Laboratory. As is the case over nearly the whole of South Africa, Rhodesia is a "redwater" country—that is to say, the blood parasites producing the allied diseases of "redwater" (*P. bigeminum*) and "gall-sickness" (*A. marginale*) are present in the blood of all the indigenous cattle, to which, in addition to the injury through the direct action of the disease, they do harm by stunting growth to some extent. Through the agency of ticks the disease is transmitted to imported cattle from tick-free districts, and to cattle which come from ranches where constant dipping is practised. The better bred the animal, the more virulent the form these diseases take. It is gradually becoming more and more apparent that much of the disease among Rhodesian cattle, and especially among calves, chronic or otherwise, is due to the tick. The one satisfactory preventive measure is to dip regularly once a week. Regularly dipped cattle enjoy more peace and freedom from the worry and torment of all sorts of biting and stinging insects—a freedom which is reflected in their shining coats and general health and condition.

Dipping Tanks.—There were in 1910 approximately 100 dipping tanks in Southern Rhodesia; to-day there are 1,639, or upwards of one per thousand head of cattle. Weekly dipping is compulsory throughout the country except in a few portions occupied solely by natives, but in which tanks are being erected as speedily as builders can be found and other circumstances permit, and it is hoped to have the whole country under compulsory dipping within two years from date. This unusual feature in veterinary regulations, probably without parallel throughout the world, materially influences cattle management. It eliminates the possibility of true ranching as it is understood elsewhere, and introduces a method of close herding which would be uneconomical in a country without cheap labour. The system is further justified owing to the scarcity of skilled white stockmen and of horseflesh, and also because of the prevalence of bush and broken country, and particularly because of the presence of wild carnivora, lion, leopard and wild dog. These factors render frequent rounding up necessary, and regular dipping gives the opportunity for this, apart from being an invaluable insurance against and preventive of many diseases.

The Veterinary Department.—The Veterinary Department in Southern Rhodesia is a distinct entity, directly under the Treasurer. It consists of a Chief Veterinary Surgeon stationed in Salisbury, who holds also the position of Controller of Cattle; an Assistant Chief Veterinary Surgeon, stationed in Bulawayo, who is Chief Inspector of Cattle; six District Veterinary Surgeons; five Assistant Veterinary Surgeons, and about fifty Cattle Inspectors. The Veterinary Department is composed of administrative and field officers, and is arranged as follows:—The Territory is divided up into 41 areas known as Cattle Inspectorates; in charge of each one of these areas is an experienced Cattle Inspector, who is responsible to the District Veterinary Surgeon for reporting and investigating outbreaks of disease and for generally carrying out the regulations affecting live stock. The balance of about ten Cattle Inspectors is employed for relieving purposes and otherwise as temporary men in assisting in the suppression of outbreaks of disease, the supervision of cattle dipping tanks, etc. A certain number of such inspectorates are grouped together and form a veterinary district in charge of a District Veterinary Surgeon, viz., Salisbury, Bulawayo, Gwelo, Victoria, Umtali and Melsetter. The Assistant Veterinary Surgeons are stationed at different centres, mostly in Salisbury and Bulawayo, and are employed in the suppression of outbreaks of diseases, investigating, testing and advising treatment for disease, and in other ways assisting stock owners. Another section of the Veterinary Department is the Veterinary Laboratory, in charge of the Government Veterinary Bacteriologist, at which research into diseases affecting animals, preventive inoculations and other treatment, microscopical examinations and the manufacture of vaccines and sera are carried out. The work performed by this branch has so increased in volume and been found of such material benefit to the country, that considerable further accommodation in the form of new and substantial buildings is to be erected immediately, and the staff will probably be increased by the appointment of one or two fully qualified Assistant Veterinary Bacteriologists.

The Ordinances and Government Notices affecting live stock in Southern Rhodesia have been compiled and published in readily available form for the guidance of all interested.

Chapter V.

TRANSPORT.

Rhodesia being a country of great distances, the movement of cattle or meat occupies a very important place in the consideration of the problems of the cattle and beef industries. In some other lands, where there is much open country and few railways, the custom of moving cattle on the hoof along stock routes is general. For certain reasons this method cannot attain any great development in Rhodesia, although, of course, driving cattle for a long distance must often be resorted to.

To send cattle alive by road to Beira or the Congo is impossible, owing to the existence of tsetse fly in the regions to be traversed, and the restrictions on cattle movement on veterinary grounds also render such a system virtually impossible. For cattle to walk through Bechuanaland to Johannesburg is also not feasible, as owing to pleuro-pneumonia in that Protectorate cattle from there are only allowed into the slaughter markets of the Union, and by rail. Moreover, the Transvaal is too closely occupied to allow of regular movement of large numbers of cattle to the markets by road. A stock route westwards through the great vacant stretches of Ngamiland and the South-West Protectorate to Walvis Bay has been suggested, but this implies crossing two deserts, the Kalahari and the Namib, and would therefore be a very precarious undertaking. Fortunately we have railway lines traversing our cattle raising regions and proceeding in the directions of the present and prospective outlets, Johannesburg, Durban, Lourenco Marques, Elisabethville and Beira.

Hitherto the southern markets have stood us in great stead in providing a market for whatever surplus cattle we have had, and it is earnestly to be hoped that this outlet may long continue; indeed, the cattle industry of Southern Rhodesia is entirely dependent on the meat markets of the Union. It is, however, at best a doubtful one, and should the demand there slacken through increased local production or other causes, it might any day be closed, and Rhodesia, being the most remote source of supply, with the heaviest charges for reaching that market, suffers most and first from any diminution of the demand. In any event, therefore, the cattle industry of Rhodesia is largely dependent upon the railways to provide a means of reaching the market, whether the beef travels alive or dead.

Cattle Traffic by Rail.—For the ordinary conveyance of cattle in Southern Rhodesia railway trucks such as obtain throughout South Africa are in use, and arrangements can be made where necessary for feeding and watering, although, even so, undoubtedly the traffic in cattle is commonly attended with very great suffering and fatigue to the animals owing chiefly to the long distances and to delays on branch lines, where trains are few and connections inadequate—circumstances which can only improve with increase of traffic. The end loading system in vogue in other cattle countries is not known in South Africa. At present the only method of exporting our surplus finished animals is by sending the live beast, and it must be recognised that the very long journey involves suffering to the animals and risk of death and bruising, besides certain loss of weight and condition, and deterioration of the flesh through nervous fatigue and physical exhaustion. The journey from Bulawayo to Johannesburg is usually 48 hours, without a break and without food or water for the beasts, and the trip from Messina to Maritzburg is even longer.

The opinions of a number of dealers operating in Rhodesia and on the Johannesburg markets were sought as to the shrinkage on cattle *en route*, from which it would appear that light cattle lose about 20 to 25 pounds dead weight, and mediums from 30 to 50 pounds according to size. Younger cattle lose more than older animals, and grass-fed

than stall-fed stock. On long journeys an allowance of at least 10 pounds dressed weight per day may be reckoned. The shrinkage on veld-fed cattle proceeding by rail from Rhodesia to Johannesburg may be put at not less than 10 per cent. These impressions of practical men are borne out by the results of a recent actual test with very prime stall-fed cattle sent by rail to Johannesburg from the Government experiment farm, Gwebi, twenty miles beyond Salisbury. The duration of the journey, including a rest of 24 hours in pens at Bulawayo, was 117 hours, and from Bulawayo to Johannesburg direct without a break, 53 hours. From actual figures covering 15 head it was found that the average loss was 163 pounds live weight per head, and the net loss after watering and feeding and rest still averaged 115 pounds per head, which, as these animals killed over 60 per cent. dressed weight and sold at an average price of 7d. per lb., is equivalent to a loss of 43s. per head owing to wastage on the journey. Two other consignments of the same cattle, which could not be weighed on arrival to ascertain the gross loss, showed, after recuperative rest, watering and feeding, a net average loss of 107 pounds live weight, or 8.4 per cent. over the 24 head. Those particularly interested in details of these experiments are referred to Bulletin No. 381, obtainable on application to the Department of Agriculture, Salisbury.

Conveyance of Meat.—The transport of chilled or frozen meat obviates all these disadvantages to a very great extent, but on the other hand it presents difficulties of its own connected with control of temperature and storage at the coast pending shipment. As yet no meat freezing works exist in Rhodesia, but, in view of the probability of such factories being established in the near future, the railway authorities have been consulted, and have kindly furnished the information herewith published, which may be regarded, therefore, as authoritative. The General Manager of the B. & M. & R. Railways writes as follows on his general attitude in regard to this matter:—

“I may say at once that the Railways are entirely sympathetic towards the cold storage movement, and will always be ready to render such reasonable assistance as may lie in their power consistent with their general policy of running the Railways on a sound commercial basis. In giving this assurance I would point out that in the event of the cold storage business developing to any great extent, the Railways would be put to very heavy capital expenditure for the provision of the necessary rolling stock, an expenditure which would probably be much greater than that involved in the erection of works and plant by the Cold Storage Company, and the latter must not expect the Railways to grant any special concessions in the way of private sidings or other works, the cost of which is usually borne by the public.” This sympathetic assurance is all that can be looked for at the present stage, and its expression in practical form must depend upon future developments.

Railway Rates and Facilities.—The cost of railage alone from Bulawayo to Johannesburg works out at rather over £2 a head, a heavy charge on the industry. The question of railway rates is always a burning one in Rhodesia, where the charges are heavily felt by the sparse

population, of whom such a large proportion are still in the early stages in the development of their farms, trades or occupations, not yet well established and necessarily struggling. The great distances, the comparatively small though increasing volume of the traffic, the high costs of management and maintenance in a country remote from the great centres of engineering construction, and the economic situation, all contribute on the other hand to render low costs impossible. A compromise between these divergent interests is difficult, yet on the whole is being achieved. Thus in the appended views of the General Manager on the much vexed question of rates and facilities for traffic, this effort to meet different if not divergent interests is indicated.

"It is a little difficult to give any definite information on the subject of rail charges, as we are at present engaged on a general revision of our rates, with a view to adopting the same classification as is in operation on the Union Railways, and I feel that under the circumstances it is useless to give detailed particulars on this point, as any rates quoted are likely to be revised within the next twelve months or earlier. I am not at the moment in a position to say how this revision will affect the charges on all the various classes of traffic, but as a rough guide I give below the present rates in operation:—

(a) *Live Stock for Slaughter*.—The ordinary rates for live stock in local traffic are as follows:—

- 8s. per short truck for every 10 miles or part thereof, up to and including 250 miles, and
- 4s. for every 10 miles or part thereof beyond. Minimum charge £2 per short truck.

"In the case of the Odzi Meat Packing Company special rates were quoted, and these would be applicable to cattle traffic consigned to cold storage works:—

- Up to 150 miles—ordinary tariff rates
- 151 to 200 miles—ordinary tariff rates, with maximum rate of £5 10s. per short truck
- 201 to 250 miles—£6 per short truck
- 251 to 300 miles—£6 10s. per short truck
- 301 to 400 miles—£7 10s. per short truck
- 401 to 500 miles—£8 10s. per short truck.

"For distances exceeding 500 miles the above rate of £8 10s., plus 4d. per short truck per mile.

"The above special rates apply to a maximum of 12 animals per short truck, and 24 per bogie truck. Above this number an additional charge *pro rata* is made, subject in all cases to the ordinary tariff rates as a maximum.

"Bogie trucks are charged double the short truck rates in all cases.

"These rates are subject to a surcharge of 33½ per cent.

(b) Frozen or chilled meat conveyed in refrigerator vans is charged at rate 5 over these lines, subject to a minimum charge as for half the marked weight carrying capacity of the truck used.

(c) Canned meat, in minimum quantities of one ton, or paying therefor, consigned direct from a canning factory in Rhodesia is charged at the 3rd class rate; smaller quantities rate 2.

(d) Hides.—In local traffic dry hides are charged at 3rd class rate, and wet hides at 3rd class rate less 20 per cent. Hides consigned to Union or to Beira, for export oversea, are charged at 4th class rate, wet hides being charged at rate 4 less 20 per cent.

(e) Coal.—The present rates for coal in full truck loads from Wankie are as follows:—

Wankie to Bulawayo	9s. 3d. per ton
Wankie to Gwelo	13s. 0d. per ton
Wankie to Salisbury	20s. 8d. per ton
Wankie to Odzi	28s. 4d. per ton

(f) Fertilisers and Bones.—In minimum quantities of one ton, or paying therefor, are charged at the scale of rates under Scale B; smaller quantities rate 4.

(g) Shooks.—In minimum quantities of 10 tons, or paying therefor, are charged at a special rate from Beira of 2½d. per ton per mile when consigned distances of 200 miles and over. For shorter distances rate 4 applies, subject to a maximum charge of 44s. 5d. per ton. Between other points this traffic is charged at tariff 4.

Special Railway Rates.

So far there have been no definite arrangements made with the Railways as to special rates for (a) the conveyance of slaughter stock to a freezing works, (b) for cold storage products to the ports or the other distributing centres, nor (c) for the products of such works, such as tallow, candles, fertilisers, leather, soap, etc., should such be turned out. The general impression is that the Railways are very much in favour of such works being established, and would consider these points and welcome discussion on the subject. In regard generally to facilities for the cattle and meat traffic, the General Manager of Railways proceeds:—

“It is the practice of the Railways to provide loading facilities for cattle stations and public sidings where required, and these facilities would be provided, or existing facilities extended, to meet any extra requirements brought about by the establishment of a cold storage industry in Rhodesia. Off-loading facilities would also be provided by the Railways at such points as may be ultimately selected for the erection of cold storage works, provided they were required at a station or public siding and circumstances permitted. All constructional material and machinery required for the erection of freezing works would be charged at full ordinary tariff rates. It has never been the practice of these Railways to grant any special rates for traffic of this nature, and you will appreciate that if special reductions were granted in the case of meat freezing works, it would be practically impossible to refuse similar concessions in many other similar cases where plant and machinery are imported for the starting up of new industries. Any private siding required would be put in on the usual terms.

"As regards the supply of water, the Railway dam built at Khami probably provides sufficient storage of water to enable us to meet the requirements of cold storage works. At present, however, the conditions under which we have been given rights preclude the use of the water for other than Railway purposes. I am now in communication with the Water Board with a view to getting these conditions altered so as to enable the Railways to provide water for the cold storage works. At present I am not in a position to say whether our application will be agreed to.

"Most of our cattle trucks have a floor measurement of 20 feet by 7 feet 5 inches, and the number of head of cattle that can be loaded varies from 8 to 14, or even 16 in the case of small animals. The present cost of cattle trucks, including erection, is from £1,000 to £1,200.

"I do not anticipate that there will be any difficulty in furnishing an adequate supply of cattle trucks. We put 50 additional trucks into service towards the end of last year, and we have a further 15 trucks on order.

"The two terms 'refrigerator trucks' and 'insulated trucks' are somewhat loosely used, but as I understand their meaning, the former term is applied to trucks which have some mechanical or chemical means of cooling by brine circulation or otherwise. The term 'insulated truck' is applied to a vehicle in which no such mechanical means exist.

"In order to avoid shunting *en route* and to get the best possible transit to the Congo and to the south, it would be necessary for frozen meat to be hauled in full train-loads. Under present conditions it would be possible to attach an insulated truck to the mail trains to the Congo, but not more than one on each train. It is estimated that, in order to provide a regular full train service for this traffic to the Congo and to the south, not less than 30 vans would be required. The cost of these 30 trucks would probably be about £80,000, and I anticipate some difficulty would be experienced under the present difficult monetary conditions in finding the necessary funds. Once the sanction of my Board has been obtained to the expenditure, the time occupied for construction and delivery of the vans would probably not exceed 15 months, but this depends very much on conditions in the trade and whether rolling stock manufacturers are busy or not. Before sanctioning the expenditure my Board would no doubt require to be fully satisfied that the export of meat from Rhodesia is a feasible proposition.

"*Insulated Trucks.*—At the present time we have only three small so-called refrigerator cars, and these have a capacity of 30,000 lbs. load. It would therefore be necessary to provide further rolling stock, and, assuming that the trucks purchased by these Railways were similar to the latest type of S.A.R. insulated truck, the particulars you ask for are as follows:—

Floor length, 39 feet 2 inches

Floor breadth, 7 feet 2 inches

Height of truck (interior), 6 feet 4 inches

Load, 35,000 lbs.

“With regard to the loading of these trucks and the conveyance of frozen meat generally, the South African Railways write me as follows, under date 21st December :—

“With reference to your letter G.M. 337a of the 26th ultimo, the experience of this Administration in the conveyance of frozen meat has in the past been confined to journeys occupying from 24 to 30 hours, and when the meat has been efficiently treated and frozen in the cold storages and the bone temperature has not exceeded 12 deg. Fabr., the carcasses have carried well. The question as to whether a lower degree of bone temperature is necessary for successfully undertaking journeys of 96 hours is one which could only be determined by actual experiment.

“Regarding the use of ice for maintaining insulated trucks in a cool condition throughout, a perusal of the following points will perhaps assist in arriving at a decision whether ice is necessary or otherwise :—

- “(a) The insulation of trucks must be of suitable thickness and quality, and not only the sides, but also the roof and floor of the trucks should be insulated, and special attention paid to the doors to render them airtight.
- “(b) Pre-cooling.—Trucks should be pre-cooled, and the inside temperature of the trucks reduced as much as possible. This is held by some to be very necessary. In other quarters, however, it is held that pre-cooling is not warranted on account of the expense involved, such pre-cooling requiring either brine tubes wherein moving brine is circulating during loading and the pipes remaining full of brine during transit, or alternatively the provision of large blocks of ice in the truck for some time preceding the commencement of loading operations. Pre-cooling of trucks is, however, not a matter for the Administration to arrange, but is entirely one for the cold storages loading the meat, although, of course, the Administration considers pre-cooling essential to obtaining satisfactory results.
- “(c) There is diversity of opinion in regard to the bone temperature that should obtain at the time of loading, certain officers and others connected with the abattoirs and cold storages holding that it should be 10 and some 12 degrees, but all are unanimous in regard to what the final temperature should be before shipment, viz., not more than 24 degrees.

“The average weight of a quarter may be placed at anything between 150 and 170 lbs. Quarters below 130 lbs. in weight, except in the case of young cattle, when 125 lbs. is the minimum, are rejected for export by the Union Agricultural Department.

“Our latest type of insulated and refrigerator trucks have carrying capacities of 35,000 and 45,000 lbs. respectively, whilst the tares average 53,000 lbs.

'The average number of quarters which can be loaded per truck is 180.' "

Against the cost of supply of insulated or refrigerator trucks may be set their much smaller number as compared to cattle trucks, one of the former carrying 180 quarters or 45 carcasses, or in the Union up to 50 carcasses, as against 8 to 14 head in the latter, whilst there would be a corresponding reduction in the train service and the locomotives required. The more concentrated and valuable commodity, meat, could bear higher rates than the comparatively bulky and lower valued live beast. Live cattle, in addition, require much special attention *en route* not called for in the case of the beef train, which travels through from point to point with a minimum of attention, and the only factor of concern being expeditious delivery, implying a minimum of detention of trucks on each occasion that they earn revenue to the Railway.

Duration of the Journey.—Not only is the cost of transport high, but the journey to our present markets is long and very tedious. The decision of important points affecting the future meat industry must hinge on the question of the probable duration of journeys under normal conditions, both of live stock and of refrigerator vans. Of course these figures in the accompanying four tabular statements can only be approximations, but even as such they are instructive, and on certain issues decisive. It is for convenience assumed therein that the section between West Nicholson and Messina is constructed, which of course is not the case, and actually at present access to Lourenco Marques and Maritzburg would either be by way of Bulawayo, Mafeking and Johannesburg, or from Messina for cattle moved to that point on foot. It is to be observed also that in the two tables for live stock an allowance is made in all marked cases of twelve hours for rest, watering and feeding in pens after approximately 36 hours in trucks.

(A)

NORMAL DURATION OF RAILWAY JOURNEY FOR LIVE STOCK IN ODD TRUCK LOADS.

To	From			
	Bulawayo hours.	Gwelo hours.	Salisbury hours.	Odzi hours.
Bulawayo	—	6	19	30½
Gwelo	7	—	12½	24
Salisbury	19½	12½	—	8½
Odzi	31½	24½	9½	—
Beira	57	50	26½	16
Mafeking	32½	50½	63½	75
Kimberley	61	79	92	103½
Capetown	118½	136½	149½	161
Johannesburg	44½	62½	75½	87
Durban	92	110	123	134½
Livingstone	21	30	52	63½
Kafue	40	58	71	82½
Broken Hill	61½	70½	83	104
Elisabethville	101½	110½	124	144
Bukama	145	154	167	187½
Messina	19	28	40	61½
Pretoria	42½	62½	74½	85
Maritzburg	94½	116½	126½	137
Lourenco Marques	90½	110½	122½	133

Twelve hours allowed for feeding, watering and resting after approximately every 36 hours in trucks.

(B)

NORMAL DURATION OF RAILWAY JOURNEY FOR LIVE STOCK IN TRAIN LOADS.

To	From			
	Bulawayo hours.	Gwelo hours.	Salisbury hours.	Odzi hours.
Bulawayo	—	6	17	26
Gwelo	7	—	10½	20
Salisbury	19	12	—	8½
Odzi	30	23	9½	—
Beira	57	50	26	15½
Mafeking	31	49	62	69
Kimberley	59	77	88	99
Capetown	114	132	143	152
Johannesburg	43½	61½	72	81½
Durban	89½	107	118½	127½
Livingstone	18	25	47	56
Kafue	37	55	66	75
Broken Hill	57	64	75½	95
Elisabethville	96½	103½	115	134
Bukama	139	146	157	177
Messina <i>via</i> West Nicholson	19	26	38½	57
Pretoria <i>via</i> West Nicholson	41	60	72	79
Maritzburg <i>via</i> West Nicholson	90	110	122	129
Lourenco Marques <i>via</i> West Nicholson	77	98	108	116

(C)

NORMAL DURATION OF RAILWAY JOURNEY FOR CHILLED
OR FROZEN BEEF IN ODD TRUCK LOADS.

To	From			
	Bulawayo hours.	Gwelo hours.	Salisbury hours.	Odzi hours.
Bulawayo	—	6	19	30½
Gwelo	7	—	12½	24
Salisbury	19½	12½	—	8½
Odzi	31½	24½	9½	—
Beira	47	40	26½	16
Mafeking	32½	38½	51½	66
Kimberley	50½	46½	72	79½
Capetown	94	102	116	127½
Johannesburg	44½	52½	66	78
Durban	80	88	102	113½
Livingstone	21	30	43	54½
Kafue	37	46	59	70½
Broken Hill	49½	58½	61	83
Elisabethville	78½	87½	101	112
Bukama	114	123	136	147½
Messina <i>via</i> West Nicholson	19	28	40	52½
Pretoria <i>via</i> West Nicholson	42½	51½	64½	77
Maritzburg <i>via</i> West Nicholson	85½	93½	106½	120
Lourenco Marques <i>via</i> West Nicholson	78½	90	102½	116

(D)

NORMAL DURATION OF RAILWAY JOURNEY FOR CHILLED
OR FROZEN BEEF IN FULL TRAIN LOADS.

To	From			
	Bulawayo hours.	Gwelo hours.	Salisbury hours.	Odzi hours.
Bulawayo	—	6	17	26
Gwelo	7	—	10½	20
Salisbury	19	12	—	8½
Odzi	30	23	9½	—
Beira	45	38	26	15½
Mafeking	31	37	48	57
Kimberley	49	45	67	75½
Capetown	90	98	108	116½
Johannesburg	43½	51	61	70
Durban	77½	85	95	104
Livingstone	18	25	36	44½
Kafue	33½	40½	51	60
Broken Hill	42	49½	60	69
Elisabethville	70	77	88	97
Bukama	102	109	120	128½
Messina	19	26	38½	45½
Pretoria	41	48	60½	67½
Maritzburg	78	87	99	106
Lourenco Marques	67	73	82½	94

Even if the protective and preventive policy of Northern Rhodesia which has so far barred the Congo markets to Southern Rhodesia should be amended, yet the duration of the journey from Bulawayo to Elisabethville must of itself remain a serious hindrance to the sending of live cattle to that distant point.

Railway Extensions.—Prospective extensions of the railway system are always subjects of much speculation, and these must be dependent upon economic and political developments, which cannot be precisely foreseen. A line from Shabani to the main line near Daisyfield has recently received the sanction of the Legislative Council. The following list may be taken as probabilities when circumstances allow, to which, however, no committal has yet authoritatively been given:—

- (a) West Nicholson and Messina;
- (b) Umvuma and Odzi;
- (c) Wankie (point near) and Walvis *via* Grootfontein;
- (d) Sinoia and Kafue Bridge;
- (e) Victoria and Chimoio *via* Chipinga.

Whatever other lines may be built, these are at least probable at some future date.

Stock Routes.—The movement of cattle in transit by road is controlled by permits issued by the Government Veterinary authorities; the formalities entailed only present difficulties in areas which are under quarantine. This system enables a check being kept on the movement of cattle, and is a method of preventing the spread of disease.

It is highly important in a country where the cattle are chiefly and almost wholly raised on grass, that there should be facilities for getting such cattle to market at the least possible expense, and at the season of the year when they are in best condition. Ranch cattle never bring such high prices as do those which are stall fed or finished on grain or other concentrated food, but while the latter must travel by rail, the former, if carefully walked to market, will rather improve than lose condition and weight by the time they arrive.

The early days of a country when land is cheap and only partially occupied is the time to arrange stock routes for future use. The probable markets should be ascertained and routes arranged to these markets. There is one such route already established in this country to Messina from Victoria; and others should be early arranged as may, after careful survey, be found expedient.

The stock route is not a continuous strip, but consists of a chain of grazing areas reserved for cattle in transit, and supplemented with dipping tanks and water. It is to be regarded as a provisional arrangement pending extension of railways. A serious obstacle on the Messina route is the Limpopo River, which cannot be crossed when in flood, which happens at the time of the year when, grass being abundant, stock are most readily moved on foot, and are in the best condition for the market. From Messina the journey is comparatively short by rail to Johannesburg or Lourenco Marques, and the cattle can even be railed thence to Maritzburg.

In connection with the movement of cattle on foot, it is to be borne in mind that every farm in Rhodesia carries with it as an easement or encumbrance the right of outspan for passing cattle. This right will in time to come to be a great burden on many owners, particularly those who are good breeders of stock or are situated on the line of march to some cattle centre. Water and grass are the right of each passing herd of cattle for a few hours. Just where these passing cattle may go on a farm to get this grass and water is a matter determined by usage. The owner of a farm may, however, definitely define this right by setting apart, with the consent of the Government, an area equal to 5 per cent. of his holding, to be declared the outspan of that property, and cattle passing over the farm must seek their grass and water there, and to go elsewhere on such a farm constitutes a trespass. Until such outspan is declared, the control of grazing and watering of cattle on a farm is difficult. The land is not lost to the owner. It remains his always, though passing cattle have the right to use it.

Chapter VI.

MARKETS.

Supplies and Surplus.—Calculations of available supplies depend on classification according to age and sex based on returns received from the cattle raisers of the country and compiled officially since 1914, so that the average figures are based on statistics received over six years. The figures agree sufficiently closely with similar computations framed in 1916 by the Resources and Munitions Committee of Bulawayo.

Class.	Percentage of total.	Estimated totals.
Cows over three years of age	30	450,000
Yearling steers	12	180,000
Yearling heifers	12	180,000
Two-year-old steers	10	150,000
Two-year-old heifers	10	150,000
Three-year-old steers	7.5	112,500
Three-year-old heifers	7.5	112,500
Three- to four-year-old steers	5	75,000
Steers over four years	4.75	71,250
Bulls	1.25	18,750
	100	1,500,000

These figures may be regarded as sufficiently accurate for practical purposes. They are the outcome of calculations which can be verified, but which would only overburden this Memorandum with tabulations if inserted here. Slaughter stock is drawn from every class, and for local use, unfortunately, from young cows to a greater extent than is generally believed. The cattle of Southern Rhodesia achieve their ultimate destiny, apart from a mortality of probably rather under than

over 5 per cent., by export and by local consumption. The figures may for practical purposes be taken for the past two years as under:—

1920	Local consumption, say	75,000
	Export	32,282
		107,282
1919	Local consumption, say	75,000
	Export	29,670
		104,670
		1920. 1919.
	Total cattle at 1st January	1,331,284 1,210,547
	Local consumption, say	75,000 75,000
	Export	32,282 29,670
	Total disposed of	107,282 104,670
	Percentage disposed of	8.05 8.64

The percentage of our cattle actually exported each year since it began on a commercial scale in 1916 has been as follows:—

Date.	Total Cattle at 1st January.	Slaughter Stock exported and Canning Factory requirements.	Percentage of export to total stock.
1916	840,926	12,928	1.53
1917	960,025	13,299	1.38
1918	1,083,943	23,457	2.16
1919	1,210,547	29,670	2.45
1920	1,331,284	37,341	2.8

The cattle used at the Canning Factory have been included in the above statement, since they would otherwise have been exported alive, and the meat was and is intended mainly for export. The increase of our surplus available for export is reflected in these figures. From these known figures for the past it may be interesting to attempt to anticipate the surplus available for export, dead or alive, during the next few years. To arrive at an estimate it is fair to take 8 per cent. of the total estimated census, and to deduct therefrom a slightly increasing number yearly for local consumption, thus:—

Date.	Estimated number of cattle.	Mature Stock at 8 per cent.	Local Consumption.	Number available for export.
1st January, 1921	1,500,000	120,000	75,000	45,000
" " 1922	1,680,000	134,000	77,400	57,000
" " 1923	1,881,000	150,480	80,480	70,000
" " 1924	2,106,000	168,480	81,480	87,000
" " 1925	2,358,000	188,640	83,640	105,000

No account has been taken in the above of cattle available from adjoining territories. Any calculation using other factors can readily be made on the above figures, the basis on which they have been reached having been explained above. They can of course only be regarded as forecasts and subject to all the hazards of such prophecies. The general introduction of European blood, apart from other influences, must undoubtedly promote earlier maturity, and so increase the proportion of cattle annually ready for consumption. In calculations as to the future it is fair, therefore, along with enhanced numbers, to assume a higher rate of availability. With the opening up of a demand for our oxen the proportion of females to males must rise, and hence the rate of production will be accelerated, a feature assisted also by the continuous importation of heifers from the south.

It is not possible to give in actual figures the numbers of cattle sold by natives each year to Europeans either for breeding purposes or for slaughter. The extent of such trading varies in different part of the country. Within range of Bulawayo many native herds have practically no oxen over four years old, all being sold, even those set aside by each owner "for the spirits," though these latter are replaced by younger animals. Round Victoria a large number of breeding stock are bought from the natives, also oxen, practically the entire increase of the year being counterbalanced by this trade. In the midlands and round Salisbury natives now sell cattle more freely than in previous years, and only in the more remote districts, where stock is not plentiful, and along the eastern border, where it is numerous, is the old tendency to retain cattle as an indication of wealth and as an end in itself, still pronounced. Generally speaking, it may be said that native cattle are to an increasing degree reaching the market and becoming available for beef, though as yet the class of beast is too small and often too old, thin and tough, to be suitable for export overseas, though much of it satisfies the Johannesburg standard for mediums.

Imports and Exports.—Up to 1916 the importation of meat in all forms was on the increase, and there was a shortage of fresh beef, with rising prices, whilst oxen, along with breeding stock, were being imported from North-Eastern Rhodesia and Nyasaland, and oxen only from North-Western Rhodesia, which territory placed an embargo on the export of its cows and heifers. The following table speaks for itself:—

TABLE M.

Import of Fresh, Frozen and Preserved Meat, excluding Sheep, Goats and Pigs for Slaughter, Fish, Bacon, Ham, Poultry and Game, and Export of Slaughter Stock.

Year.	Imports.	Exports.	Balance of Trade.	
			Dr.	Cr.
	£	£	£	£
1910	46,219	—	46,219	—
1911	35,069	—	35,069	—
1912	26,867	—	26,867	—
1913	32,369	—	32,369	—
1914	24,597	—	24,597	—
1915	10,461	—	10,461	—
1916	4,788	112,800	—	108,012
1917	1,758	136,104	—	134,346
1918	1,844	216,867	—	215,023
1919	3,112	233,955	—	230,843

Export of slaughter stock commenced in 1916, and at once transferred the balance of trade in this respect to the right side, to the tune to-day of nearly a quarter of a million sterling annually.

Oversea Markets.—Up to the present the local and Johannesburg markets have provided a sufficient outlet for the Rhodesian cattle surplus, and at fair prices. The time has now arrived when production has outstripped local and South African demand, and far from being a cause of any dissatisfaction or pessimism, this fact should be a source of congratulation as showing that Rhodesia is simply following, in a perfectly normal manner, in the footsteps of all other successful cattle-raising countries. That we have reached this stage somewhat sooner than was expected is all to the good, showing the potentialities of the country in this particular line. The future prosperity of the industry is, however, entirely bound up with the problem of providing adequate markets, and this must be earnestly considered at once by all those connected with the industry, landowners, stockowners and Government alike.

There is no use in shutting our eyes to the fact that for many years to come the great bulk of the meat raised in Rhodesia (and in South Africa as a whole) will not reach the Smithfield standards. It is too

lean for North European tastes, but seems well suited to the requirements of Central and South Europe, in which countries, it is generally admitted, there exists a strong demand. Exchange and other difficulties of a financial nature for the moment stand in the way of this natural supply and demand meeting each other. The Union Government, however, has recently made efforts to find a market for local produce, such as wool and meat, by entering into negotiations with the Central and other European States whereby a system of barter or exchange can be reduced eventually to terms of cash, to the great benefit of both parties. It would be a pity if Rhodesia missed an opportunity to participate in any advantageous movement of this kind.

The Union.—The Union of South Africa is a cattle exporting country to the extent shown by the following Customs figures, furnished by courtesy of the Director of Census, Pretoria.

EXPORT OF BEEF FROM THE UNION OF SOUTH AFRICA.

1910	...	...	...	...	...	1,700,250	pounds
1911	...	...	...	...	...	1,133,084	"
1912	...	...	...	...	...	866,665	"
1913	...	...	...	...	...	743,233	"
1914	...	...	...	...	...	1,094,163	"
1915	...	...	...	...	...	6,168,174	"
1916	...	...	...	...	...	19,270,821	"
1917	...	...	...	...	...	49,997,949	"
1918	...	...	...	...	...	21,135,367	"
1919	...	...	...	...	...	46,363,180	"
1920	...	...	...	...	...	12,649,800	"

*From Weddel's Review of the Frozen Meat Trade, 1920.

The amount exported in 1919, which at an average weight per beast of about 610 lbs. would represent 76,000 head, is in part balanced by an importation in that same year from Rhodesia of 21,000 head for slaughter, and from other adjacent countries almost as much. To-day the Union takes from Rhodesia approximately 30,000 head per annum, thereby liberating a corresponding number to be exported from nearer the coast, a practice which we have not yet achieved, although Rhodesia lies by no means far from the sea. The trade, however, has not been entirely one of substitution, and a certain number of Rhodesian cattle have been actually exported through Durban, a matter dealt with from another aspect elsewhere in this report. As regards the quality of Rhodesian meat sent to Johannesburg to-day, reports have been secured from the leading dealers, and these are conflicting, varying probably by reason of the class of trade in which each specialises. They agree, however, that of recent years an improvement has been recognised, and it would appear correct to say that one-third would be classed as primes, one-third medium and one-third compound, with a tendency for the primes to increase and the compounds to diminish. It would appear that Rhodesian primes compare very favourably with Union primes in quality and weight, in spite of their disadvantage from long transport, averaging about 700 pounds dressed weight, but that the mediums and compounds, being from but little improved or pure native stock, are

lighter than the corresponding classes in the south, where the native breeds and the scrub and nondescript cattle tend to be larger. As the cattle of Rhodesia are rapidly being graded up, so the proportion of inferior stock must steadily fall, whilst more and more of higher grade is each year coming on to the market. The medium class run about 600 pounds dressed weight. The ordinary native Rhodesian ox sent to the south weighs only about 420 pounds dead weight, although there is in addition also a proportion of old oxen of 500 pounds and more. Prices for our stock, which are restricted to the so-called "quarantine" market, are rather below those obtained in the market open to local stock, which enjoy the advantage of being free to be moved away from the market alive, and are bought both for transfer to other places for slaughter, and for trek purposes. Prices on the Rand are somewhat higher between July and December than during the rest of the year, a circumstance which is much in favour of Rhodesia, the figures for our cattle last year being from January to June about 52s. 6d., 48s. and 45s., down even to 40s. per 100 pounds dead weight for prime, medium and compound respectively; and 60s., 52s. 6d. and 47s. for corresponding classes from July to December.

Portuguese East Africa.—The requirements of Portuguese East Africa are limited, and, based on the trade of the past two years, may be put down for the present at 2,000 oxen per annum, both for consumption and for draught purposes. This figure is likely to increase in view of the present rapid progress of farming and the development of mining in that rich and fertile country, and with the need for provisioning an increasing number of ships at the port. There is a duty leviable on both live oxen and on beef. Permission for the importation of cattle into this territory has to be obtained from the Governor of Beira through the Veterinary Department, and application must be made on official paper which carries a stamp valued at 150 reis, about equal to 6d. (sixpence). Oxen are the only class of cattle taxed at the rate of 1,000 reis per head (about 3s.), while beef pays 70 reis per kilo (about 3d.). Oxen or beef in transit through this territory for export would be charged an *ad valorem* duty on export at the rate of 4½ reis for the value of every 1,000 reis exported, which is equal to about one-fifth of a penny.

The Congo.—The Belgian Congo territory in Central Africa is divided from Southern Rhodesia by Northern Rhodesia. Its principal means of communication with Europe and America and the countries to the south is by the railways through Northern and Southern Rhodesia, though some outlet down the Congo River and Portuguese West Africa is being discussed, and will some day be an accomplished fact. The distance of the Congo border (Sakania) from Bulawayo is 788 miles. From the Congo border the railways to the north are owned by Belgian capital, and serve Elisabethville and other important mining camps. A large part of the white-inhabited country of the Congo is "fly" area, and therefore there is little in the way of live stock produced in that country. Speaking broadly, the Congo is entirely dependent on imported meat. The market of the Congo to-day takes annually about 8,000 head of oxen weighing an average of, say, 500 lbs. each. At present the supply comes from Northern Rhodesia, where the average

weight of the cattle is below that figure, so that a greater number are required to produce the amount of meat indicated. The Congo beef requirements to-day may be put down at, say, four million pounds per annum. Since the war there has been a rapid increase in population from overseas, and a great appreciation in the rate of development of the mining and other industries of that country. It is reported that contracts for the erection of housing accommodation for a large number of Europeans have been let, and that in the next few years the white population of the country will have doubled. The white population being in the nature of officials, artisans, etc., this increase means that the mining and other development will have expanded at the same rate, and that there will follow a great increase in the number of native labourers employed. The native labourer on mines is the great consumer of meat, and this expected increase of mine development means a greatly increased demand for meat suited for this trade. The position in Northern Rhodesia is that there is not, even including the Barotse Valley, sufficient cattle to supply the Congo; and owing to the fact that there is a considerable influx of new settlers into Northern Rhodesia, who are buying oxen for farm work, it is unlikely that for some years to come the stockowners there will be in a position to supply even an appreciable part of the meat needed. The Barotse Valley was swept a few years ago by lung-sickness, and a large part of the cattle of that territory was killed by the disease. A strict quarantine was raised against cattle from the valley going into Northern Rhodesia, and when the quarantine was modified a short time ago a number of oxen were available for the Congo trade. This surplus has, however, been exhausted. During the time the Barotse Valley was closed, very high prices were offered to the cattle owners of Northern Rhodesia; this resulted in the sale of all available oxen. A year ago it was credibly reported that the average weight of cattle sold in Northern Rhodesia for slaughter did not exceed 300 pounds. This is due to the fact that they were often sold not fully developed. The cattle are slow in maturing, as little improvement has been effected by breeders. There has been little introduction of better breeding stock from the south.

Prices paid for slaughter cattle in Northern Rhodesia by Congo buyers are very high compared with those ruling in Southern Rhodesia and the Union. It has been impossible to obtain official figures, as there seems to be a system of contract supply to the principal consumers in the Congo by butchers resident there. The most reliable information received shows that the cattle bought in Northern Rhodesia are purchased, f.o.r. about 52s. 6d. a hundred pounds of estimated dressed weight. These cattle are small compounds. One lot of Angoni oxen sold in June last at Kafue brought £21 each for 60 head. The estimated average weight was 650 to 700 pounds. These were said to be the finest and heaviest cattle ever marketed there. A prominent consumer in the Congo states that the very high price of meat for native labour restricts its use, and that if the meat could be put on rail at Bulawayo at the prices ruling here for the last few years the consumption of meat there would be greatly increased. It is believed that at present average Bulawayo prices for compounds, the Congo would be able to consume, within the next year or two, some 12,000 head a year, at an average weight of

500 pounds, or six million pounds of meat annually. The greater part of the Congo trade will be compounds, demand for primes being limited to a small white population. The present railway rate from Bulawayo to Sakania is about £3 a head.

The vast potentialities of the Belgian Congo as a mining country and its present rapid progress justify this region being regarded as a most important market for Southern Rhodesia in time to come, although at present access is precluded by the Administration of Northern Rhodesia preventing the transit through that territory, by rail even, of cattle from Southern Rhodesia destined for the Congo. This action is deprecated in Southern Rhodesia, since considerations of distance give Northern Rhodesia a geographical and natural advantage so great that cattle from the south will only be sent to the Congo after the Northern Rhodesian supplies are exhausted. The embargo on Southern Rhodesian cattle passing through Northern Rhodesia is the more incomprehensible, since the passage is allowed of cattle from the Bechuanaland Protectorate for consumption in the Congo.

The farmers of Southern Rhodesia have up to the present had a fairly constant market in Johannesburg for all slaughter cattle of the country, and there has been little pressure here for the opening of Northern Rhodesia for the transit of our slaughter cattle to the Congo. There has been the further consideration of the transport problem of slaughter stock alive to the Congo from Southern Rhodesia. The distance from Bulawayo to the Congo border is 788 miles, with, say, 100 miles to Elisabethville and the principal centres of distribution to-day. The present service from Livingstone to Elisabethville, one is assured, often takes five days for a truck of cattle in transit. At times the trip is made in less, but five days is not unusual. The line has not reached that stage of development of permanent way that is seen in the south, and traffic is light. The time can be reduced, but for years it will, in time and in temperature, be a trip entailing hardship on live animals being sent there. Many complaints have been made as to condition of cattle on arrival, and their great suffering *en route*.

The general opinion in Southern Rhodesia amongst practical and humane men is that cattle cannot be sent alive from this country to the Congo unless they are off-loaded at least once and rested in Northern Rhodesia for some days. It is thought that the best solution of all is that meat should be sent in refrigerator trucks to the Congo. In this attitude the Railway officials are sympathetic.

The beef at present supplied to the Belgian Congo from Northern Rhodesia, chiefly from Barotseland, is of a poor quality, chiefly unimproved cattle in poor condition averaging 250 pounds dressed weight and costing in Elisabethville 60 shillings per 100 pounds. There is a duty on cattle or beef imported into the Congo, but this charge naturally is passed on to the consumer.

The quantity so consigned, which for the moment has exhausted all supplies, is indicated in attached figures representing the total number of cattle transported to the Congo from Northern Rhodesia:—

	Number of oxen for slaughter.	Number of cows and calves.
1916	3,990	215
1917	4,008	...
1918	6,473	11
1919	7,778	...

Southern Rhodesia: Local Consumption.—It is a difficult matter to estimate the local meat consumption of Southern Rhodesia owing to the primitive conditions under which meat supplies are prepared and the scattered nature of the population. The European population may be put roundly at 40,000 souls, and the indigenous natives at 800,000, whilst 40,000 is the average number in employment in which they receive rations and who have acquired the habit of buying supplementary meat; further 10,000 boys in domestic and kindred employment in towns also get meat diet. Based on these facts the following rough calculations may be allowed:—

40,000 Europeans at 150 lbs. each per annum	6,000,000 lbs.
800,000 natives in kraals at 20 lbs. each per annum ...	16,000,000 lbs.
40,000 natives on rations at 100 lbs. each per annum	4,000,000 lbs.
40,000 natives supplementary at 50 lbs. per annum	2,000,000 lbs.
10,000 natives in towns at 100 lbs. each per annum	1,000,000 lbs.
	29,000,000 lbs.

Taking into consideration the class of cattle chiefly consumed, an average weight of 400 lbs. gives 72,500 head per annum. Another means of arriving at the local consumption of meat is from the Customs returns, which for 1919 give the net number of ox and cow hides exported as 67,097, and 91,172 for 1920, which latter figure is inflated by the local slaughter of over 5,000 head at the Odzi Canning Factory, the meat of which is intended for export. The figures for hides include those recovered from dead animals as well as those slaughtered, so that some allowance on this account should be made. It would therefore seem reasonable to assume that the number of cattle required for consumption in Southern Rhodesia to-day is about 75,000 annually. The native of Rhodesia in his own kraal is very abstemious as regards beef, and the Matabele are more thrifty in this respect than the Mashona. Only fairly well to do natives slaughter cattle, and even in such cases rarely more than one is slaughtered annually, and no great expansion of the meat eating habit is anticipated by those most conversant with the native.

The case is quite different with the natives working in the mines and other industries, who receive a regular ration imposed by law and controlled by Government Inspectors, amounting to 2 lbs. per week. It is to cattle required for this purpose that the phrase "compound" is applied, as the meat is consumed in the natives' quarters or compounds.

Weight, Quality and Price of Beef.—The average weights attained by Rhodesian bullocks depend entirely on breeding, age and treatment,

and, if got into first class condition, animals of European blood are naturally heaviest, age for age. Leaving aside the case of animals artificially fed and fattened, and dealing entirely with grass-fed bullocks, it has been found that the dressed weight of cattle killed for consumption in Rhodesia centres for the most part round 450 to 500 pounds and less, often from 400 to 650 pounds, with rarer instances up to 800 pounds. The better class of cattle killed in the larger centres for white consumption run from 500 to 600 pounds dressed weight. The term "grade" is used very elastically. The age of slaughter stock varies from four to eight years, showing that as yet no fixed practice nor any very high standard has been reached as regards our own local markets.

Since the Rand was opened in 1916 there has naturally been a tendency to send the best there to the detriment of the local consumer. Our information is derived from the villages and lesser towns as well as the principal markets in Rhodesia, so that it represents all classes and not only the urban trade.

By "prime" oxen are understood cattle going from 400 pounds to 600 pounds dressed weight, generally about 500 pounds, and from four up to six years old, though occasionally both younger and older. The proportion of such cattle depends upon the class of trade of the meat purveyor, and the price varies from 40 shillings to 50 shillings and as high as 55 shillings per 100 pounds dressed weight. This class of meat is most plentiful from January to June, particularly so from February to April, and most scarce in September and October. "Mediums" weigh between 300 and 550 pounds dressed weight, averaging 450 pounds, and are often older than the better grade cattle which supply the prime classes, running from four to eight years and even up to ten years old. "Mediums" vary from 32s. to 47s. 6d., but usually from 35s. to 40s. per 100 pounds, and are to be had all the year round, though more scarce in September, October and November. "Compound," or common cattle, used mainly for meat rations on the mines, vary from 300 to 450 pounds, averaging 350 pounds, and are mostly old, often up to 10 or 12 years, and many have worked long in the yoke. They fetch from 20s. up to 37s. 6d., with 30s. as a common price, and are most plentiful between July and December, especially about October, as they are saleable only when better stock is not obtainable and because stock which at other seasons ranks as medium now falls to this third class. Cows for beef run from 200 to 400 pounds dressed weight, and commonly 300 pounds. They are generally old, and fetch from 30s. to 40s., averaging 35s. per 100 pounds. They form only a small proportion, say, 5 per cent. of the whole, and come on to the market fairly regularly throughout the year. Calves, from 50 to 120 pounds dressed weight, bring about 50s. per 100 pounds, and are to be had at any time, but only in limited quantities. Bulls, mainly of native origin and aged, weighing about 500 pounds more or less, fetch 30s. to 40s. per 100 pounds all the year round, but are an insignificant number, as a much better market for bull beef is found on the Rand. It is thus possible to classify the meat consumed within the Territory, and to give some indication of the interpretation locally placed upon the different standards of quality.

CLASSIFICATION OF BEEF CONSUMED IN SOUTHERN RHODESIA

Classification.	Extreme and average weight in pounds D.W.	Ages in years	Price per 100 lbs D.W. in shillings
Prime	400 — 500 — 600	4 to 6	40 — 50 — 55
Medium	300 — 450 — 550	4 to 10	32 — 35 — 40 47/6
Compound	300 — 350 — 450	8 to 12	20 — 30 — 37/6
Cow	200 — 300 — 400	10 to 12	30 — 35 — 40
Calves	50 — 100 — 120	—	50
Bulls	500	6 to 10	30 — 35 — 40

The average live weight of over 5,000 cattle slaughtered in one season by the Rhodesian Meat Packing Factory is given at 735 pounds, dressing at half their live weight, or 367 pounds. The average weights are interesting:—

Classification.	Average Live weight.	Proportion of Total received.
Primes and Firsts ... Oxen	830	38 per cent.
Primes and First .. Cows	729	4 „ „
Seconds Oxen	763	21 „ „
Seconds Cows	645	13 „ „
Thirds Oxen	714	4 „ „
Thirds Cows	630	9 „ „
Thirds Bulls	830	3 „ „
Fourths Oxen	717	1 „ „
Fourths Cows	565	6 „ „
Fourths Bulls	787	1 „ „
		100 per cent.

At both Bulawayo and Salisbury the number of cattle killed under municipal control each year is about 5,000 head; at Umtali 1,100; Gatooma and adjacent mining area 4,000; Hartley takes 200 head, and other centres take similar quantities. It should be remembered that much of the meat killed at these centres is sent out to country customers,

and a large amount is used on mines and by the natives employed in and around the towns, so that these figures are no guide as to the consumption by the European urban population alone.

The accompanying particulars of meat handled by the Rhodesian Meat Packing Co., Ltd., at their works at Odzi furnish some illuminating information on the question of the quality and prices of meat, and are quoted verbatim:—

“The principle employed at the commencement was that of purchase at the factory by ‘live weight’ at advertised prices. Later on a cattle buyer was engaged to buy on the hoof, principally in the Midland districts, same being collected and sent on along the stock routes to the factory. Many shareholders and other stockowners, moreover, preferred selling outright to a buyer on their farms to undertaking all the formalities necessary for the movement of the cattle themselves. Unfortunately, however, the factory closed shortly after the buyer was appointed, and it is not therefore possible to properly compare the two methods. Difficulty was experienced regarding supplies by the former method, and same also showed signs of becoming exhausted. The employment of a good reliable buyer appears to be a necessity where any large number of cattle are required, or cattle of any particular quality. The following were the prices offered by the Canning Factory:—

	1st Oct., 1919.	1st Jan., 1920.	7th April, 1920.	4th May, 1920.
Primes	...	...	21s. 6d.	20s.
First Grade ...	22s. 6d.	21s. 6d.	20s. 0d.	18s.
Second Grade ...	20s. 0d.	18s. 6d.	18s. 6d.	16s.
Third Grade ...	17s. 6d.	16s. 6d.	16s. 6d.	14s.
Fourth Grade ...	12s. 6d.	12s. 6d.	12s. 6d.	10s.
	Rail paid	Rail paid	No rail paid	No rail paid

all per 100 lbs. live weight over company's scale. We are now obtaining 12s. per dozen 12 oz. tins of first quality meat in Rhodesia f.o.r. works, and about 11s. f.o.r. works for meat sold in the Union of South Africa. These prices would pay if the market could take all the factory was capable of producing, and cattle were at no greater average per 100 lbs. dead weight than about 35s. To make a lesser production pay at the above prices it would seem necessary to increase the value of bye-products by such means as the establishment of soap making, tanning, etc., or by finding a market for the better portions of the carcass in the form of fresh, chilled or frozen meat. So far we have had no difficulty in disposing of the bye-products of fertiliser at £12 per ton, and tallow at 10d. per lb. (f.o.r. works). The market value of hides has fluctuated considerably, but a fair value to-day of the average hide is 32s. 6d. to 35s. at works. Tallow has slumped since the closing of the works, and unless same were used for soap-making, or sold to a Rhodesian soap factory, we do not think that a higher value than 6d. per lb. could be placed on this bye-product at works. As regards beef extract, bones and horns, we are unable to give any definite value of these, but extract is quoted in England about 3s. 6d. per lb., bones at £20 per ton, and horns between 6d. and 1s. each. Tripes, kidneys, tails, etc., have not proved easy to dispose of, chiefly because we have not

found it necessary to use our cold storage plant for the beef, and therefore we have been limited to a small scale in winter only. Cold storage would make it possible to supply regular orders throughout the year. Latterly we have been successfully canning the ox tripes, and we think a fair demand could be worked up in this line. Neatsfoot oil in small quantities has been produced, and would prove useful for any leather industry started in the future."

As regards retail prices, it may be said that compound meat is cheap, contracts ranging from 3½d. to 6½d. per pound, whilst the price of beef for European consumption is generally regarded as high, and runs from 10d. to 1s. 2d. per pound according to cuts. The price of meat has not diminished with increasing local supplies, and with the advent of a regular export trade in 1916 the local retail price of meat rose, and is continuing to do so to a level unjustified, in the opinion of the consumer, by the price at which land and stock were acquired and the present cost of producing the animals. High retailers' profits are a grievance to the public, even if in turn they enable middlemen and farmers to pay the higher prices now demanded for their requirements.

Rhodesian Meat at Smithfield.—So far Rhodesian consignments of beef to England have only been of an experimental character. A small and specially selected consignment from Rhodesia, slaughtered and frozen at Johannesburg by the Imperial Cold Storage & Supply Co., Ltd., and shipped from Durban, was sent to Smithfield in 1917, and the following reports speak for themselves. Mr. R. Walsh, of the B.S.A. Company, who saw the meat in London, wrote as follows:—

"This consignment consisted of twelve carcasses of cross-bred Lincoln Reds, averaging 937½ lbs., bred and fed by E. A. Hull; five carcasses of cross-bred Aberdeen Angus, averaging 881 lbs., bred and fed by F. E. Woods; and five carcasses of cross-bred Herefords, averaging 883 lbs., bred and fed by R. Granger. It is generally conceded that the Aberdeen Angus carcasses were the best, as they were just the weight required for the London market. The Lincoln Reds were of equally good quality, but were too heavy for the trade in ordinary times. The Herefords were not quite fat enough, but owing to the scarcity of meat on the market, it all sold for the same price, namely, 9½d. per lb. for hindquarters, and 7½d. per lb. for fores. There was fault found with the manner in which it was butchered and prepared. This fault is found with all the beef from South Africa, and must be remedied. The Trades Commissioner of South Africa has repeatedly pointed out this defect, and is urging exporters to be more particular and have this beef prepared in accordance with Smithfield requirements. When properly prepared, it will add at least ½d. per lb. to the selling price. In spite of this defect, the prices realised covered all expenses, with a fair margin over Johannesburg cost. The cost of slaughtering, freezing, freight and marketing works out at about 25 per cent. of the cost of the animals on the Johannesburg market.

"Nobody expected to see such heavy carcasses coming from Rhodesia, as there seemed to be an idea that it was a country only capable of producing small cattle. Many of the men engaged in the meat trade recalled the arrival of the first consignment of beef from the Argentine

thirty years ago, and said that this first consignment of Rhodesian meat was infinitely superior. The shipment from the Argentine in 1885 of frozen beef amounted to only £343, while in 1915 the total export had swollen to £15,552,416. There is no doubt of Rhodesia becoming a great meat producing and exporting country. Particular care should be taken that only the best beef is sent from Rhodesia to Smithfield, in order to establish and maintain a good reputation. Messrs. Hull, Woods and Granger are to be congratulated on the quality of their beef, and they would have been proud if they had heard the flattering comments made on it in Smithfield."

The firm which dealt with the meat reported as follows:—

"The beef was marketed and sold off the hooks at Smithfield. Although some of the quarters were rather better than others, there was no marked difference in quality, and, having regard to the present position of the market, the consignment was all sold at one price. The beef was landed in good hard frozen condition, and had been carried from South Africa satisfactorily. Just here and there some of the flanks appeared to have been soft at some time, but this defect was so slight that it had no bearing whatever on the sale of the meat.

"*Five Aberdeen Angus, bred by Mr. Woods.*—This beef was of prime quality, but sufficient care had not been taken in the dressing. The beef had been quartered hot, which gave it a rather unsightly appearance, the forequarters particularly showing up unfavourably. The result of this insufficient cooling in the hindquarters resulted in a certain amount of animal heat being left in some of the quarters, and these on being bored were found to be rather badly bone tainted. It will be seen, therefore, how essential it is for shippers to see that beef is thoroughly cooled before dressing. The weights were satisfactory and suitable for the London trade. The quarters were well covered with fat, compact and fleshy. We noticed the aitches had been sawn through instead of chopped; the latter is the best method; the former system tends to give the animal an aged appearance.

"*Red Lincolns, bred by Mr. Hull.*—This beef was all of prime quality, but badly dressed, and had practically the same faults as Mr. Woods'. As a parcel the beef was a little too heavy for the usual London trade, but with the present shortage in all classes of frozen beef, this did not affect the selling value. The quarters were rather large framed, but well covered, and carried plenty of flesh in proportion to bone. It is to be regretted that, owing to the beef not being thoroughly cooled, a rather large amount of hindquarter meat was condemned for bone taint, and this affected principally the prime cuts. The aitches had also been sawn instead of chopped through.

"*Five Herefords, bred by Mr. Granger.*—Although this beef was of good quality, it did not show up so well from buyers' point of view as the two previous lots. The same faults were noticeable, i.e., rather bad dressing and quartering hot; but fortunately none of the meat was taken for bone taint. The 'tops' of the hinds were fairly thick and shapely, but in many cases the loins were rather poor and short of flesh. The aitches had all been sawn. The forequarters did not present a very good appearance on account of the dressing, the meat in some cases having receded slightly from the bone.

"On the whole the shipment was considered satisfactory, and much superior as regards quality to the general run of beef from South Africa. The dressing was the particular fault, and it is very essential that this should be done carefully. It can be easily understood that the good appearance and get up of a quarter in a rather dull trade will help its sale considerably, whilst good quality beef is often spoiled by careless dressing. Provided the few defects we have pointed out are remedied, we see no reason why beef such as shipped in the 'Kenilworth Castle' should not meet with a ready sale at satisfactory prices."

Apart from these preliminary trials with the best the country could produce, there were several experimental shipments of frozen beef in 1920, unfortunately from large herds of very rough stock, little if at all improved. Such shipments are apt to give altogether a wrong impression to overseas buyers of the present average product of the country, which is distinctly superior to those particular four consignments, the prices of which were 6½d. and 8½d. per pound for forequarters, and 8½d. and 10½d. per pound for hindquarters. The gross receipts for these sales were £9,221 5s., and the charges work out at 26.9 per cent. of this from the freezing works to London, and no less than 43 per cent. from the ranches. There is obviously room for improvement in the means of conveying stock to the abattoir, and the meat thence to its ultimate destination, the intermediate charges along the lines followed by these consignments taking up far too much of the value. Other consignments have met with similar results. The average shrinkage in transit between the South African port and London, based on returns for these consignments covering 1,541 quarters, is 2.22 per cent., of which details are given below:—

1.	{ 436 forequarters	2.801 per cent.
	{ 436 hindquarters	2.851 "
2.	{ 15 forequarters	1.95 "
	{ 16 hindquarters	2.105 "
3.	{ 180 forequarters	1.513 "
	{ 180 hindquarters	2.173 "
	{ 63 forequarters	1.513 "
	{ 63 hindquarters	2.173 "
4.	{ 79 forequarters	2.490 "
	{ 73 hindquarters	2.636 "

Average shrinkage 2.22 per cent.

It is unfortunate that as yet no consignments of ordinary prime veld fed or commercially stall fed bullocks have taken place, but only extremes, some much better than normal, but most of decidedly an inferior class, running only 400 and 450 pounds dressed weight.

Chapter VII.

EXISTING AND FUTURE OUTLETS.

The Packing Factory.—The factory of the Rhodesia Meat Packing Company at Odzi was originally planned and erected at a time when canned meat and extract were in greater demand than is to-day the case. The plant can easily handle 30 to 50 head per day according as 12 ounce tins or 6 pound tins are put up. It will interest all who are in any way concerned in the cattle industry of Rhodesia to know what the actual accommodation is at the Odzi Factory. It consists of the following portions:—A knocking pen; a slaughter house 50 by 25 feet, and a hide room of equal dimensions; a chill room 50 feet by 17 feet; a canning room with plant and electric motors; a complete and good tinning shop 50 by 28 feet, with machinery run by a 7 h.p. motor; a dripping and extract room 28 by 24 feet, supplied with a 3 h.p. motor; a rendering and tallow room 52 by 24 feet, well beyond the capacity of the present plant; a fertiliser room 52 by 28 feet, run by a 25 h.p. motor with a mechanical drier, and a bone mill; a packing room 30 by 16 feet; also two 50 h.p. dryback boilers sufficient for present needs; an engine room with a generator set to develop 50 h.p. voltage 500 A.C., and a Marshall engine, 40 h.p., to run a twenty ton refrigerating machine; and offices. There is a complete water service, the water being pumped from the Odzi River, one of the largest permanent rivers on the the railway system, into storage tanks, and from there to filters before use. There is ample scope on this site for extension of works up to any capacity and for such storage as might be necessary for supplies of meat for Rhodesia, the Congo, and for export through Beira, and as the factory is connected to the railways by a private siding, there is every convenience for despatch.

The present cessation of the activities of the Odzi Canning Factory is very regrettable. The occasion and necessity for this step do not appear to be due in any way to local reasons, but is attributable entirely to world-wide causes. Put simply, it amounts to this, that corned beef and extract of meat are to-day a glut in the world's markets, and are likely to remain so. In this connection it is worthy of note that Liebig's great and world renowned factories at Frey Bentos, in South America, have recently been converted from the manufacturing of essence and "bully" to freezing works for the export of meat. Tinned corned beef and meat extract were formerly prime products; they have now been relegated to the position of side lines. The markets of the world are adapting themselves for the sale and distribution of frozen and chilled meats in regions where formerly such commodities were unknown, and corned meat, which did so much to help to win the war, is now a by-product only of the freezing works, and as little of it as possible is produced. In these circumstances there is little prospect for a factory producing this article alone, of which there is a momentary glut and of which permanently more than enough can always be produced at any time. It does not, therefore, seem likely that the canning factory can re-commence on the lines of the past, but must adjust its activities

to altered circumstances and to the changing conditions of the world's meat consumption, and the company is accordingly considering the possibility of erecting freezing works in connection with the existing works at Odzi. In the present buildings, with certain alterations and within the refrigerating capacity of existing machinery working constantly, it would be possible to deal with 40,000 pounds of frozen meat weekly. It is however, to be recollected that this factory was originally erected and intended only for canning, and that any change of manufacturing processes involves structural alteration and consequent expense.

Abattoirs in Southern Rhodesia.—The provision for the slaughtering of cattle for local consumption in Rhodesia must impress the stranger as most primitive, not to say crude and unhygienic. It is indeed a serious matter of reproach that only one municipality in the country, that of Bulawayo, has provided a municipal abattoir for the preparation of its meat supplies. The meat there is regularly inspected. The charges are moderate, viz. :—

	Rate per head.	
	Slaughtering.	Inspection.
Cattle	1s. 6d.	1s. 0d.
Pigs	1s. 0d.	1s. 0d.
Sheep, goats and calves	0s. 6d.	0s. 6d.

At Salisbury there is no public abattoir, and stock is slaughtered by butchers on their own premises on the commonage, the work being supervised by a municipal sanitary inspector. At Gwelo, Gatooma and Umtali the butchers have their own slaughter poles on the commonages under the control of the council, and this is the general custom in the smaller villages. There is ample scope for improvement in this direction for the introduction of modern methods in the killing and inspection of meat for human consumption. The mines offer great opportunities for the sale of frozen meat and plucks from a central meat factory in place of the present rough and ready arrangements.

Meat Inspection.—Meat inspection is a subject that has up to the present received but little attention in Southern Rhodesia. Probably the chief reason for this neglect is the freedom of our cattle from diseases that justify the condemnation of a carcase or portion thereof as unfit for human consumption. A certain amount of inspection has been carried out at some of the larger centres of consumption, and of course all animals that have been exported for slaughter purposes to the Union of South Africa have been carefully examined by competent lay inspectors, and it has been found that there are only two diseases for which cattle have been condemned, viz., measles and tuberculosis. Measles is the cystic form of tape worm that inhabits the intestines of man, and if better sanitary arrangements are made, the existence of the disease in cattle can be reduced to a minimum. Statistics compiled from an abattoir in Rhodesia show the percentage of condemnations to be less than one-half per cent., which figure is borne out by experience in the abattoirs of the Union. The percentage of cattle suffering from tuberculosis has been found to be 1 in about 2,000 head of cattle from Southern Rhodesia slaughtered at Johannesburg. When the time arrives for the export of beef from Rhodesia, of course a thorough and

efficient system of inspection of both the living animal and its carcase will have to be inaugurated; fortunately there exists in the Veterinary Department a body of men fully qualified and competent to undertake this work and ensure confidence in its being efficiently carried out. The records of the municipal abattoirs of Johannesburg during the past five years show from inspection of carcasses a very small proportion of condemnation, chiefly for measles with a few cases of peritonitis and of emaciation, attributable to old age, amongst compound cattle. The last mentioned has been notably less in recent times. Buyers remark on the exceptional freedom from disease amongst Rhodesian cattle, particularly the absence of fluke and tuberculosis. From the point of view of protection of the human consumer, there are no regulations governing inspection of meat offered for local consumption or prepared for export at present apart from those framed under the Municipal Act. A new Public Health Act is, however, in course of preparation, which will provide for the framing of Regulations dealing with treatment and exposure of meat for sale and control of abattoirs, etc.

Cold Storages and Freezing Works.—In spite of the rapid growth of industries dependent upon cold storage, such as dairying and fruit growing for export, as yet there has been little development along this line. Refrigerator plants exist in the butter factories at Bulawayo, Gwelo and Salisbury, and separate cold storage facilities are to be found in these towns also, and in the two bacon factories at Salisbury, but none on a very large scale. At Beira there is a refrigerator plant also, but only sufficient for the needs of the town, and not suitably situated or equipped for the export trade. In the Belgian Congo there are no cold storage facilities, but proposals are on foot for the erection of a plant at Elisabethville, and this is not only a pressing necessity but an essential part of any proposals for supplying meat and other perishable foods to the Katanga copper mines from Southern Rhodesia. Cold storage would also be necessary at Kambove and Likasi. Throughout the Union there is a large number of cold storages, most country towns being so supplied, whilst at the ports and in other large cities they are numerous. Of freezing works for the slaughter, freezing, storage and export of meat to other parts of the country or overseas, there are, according to Weddel's Annual Review of the Frozen Meat Trade for 1920, some twenty in South Africa to-day, with an aggregate killing and freezing capacity of 850 head per day, while there are none in Southern Rhodesia. Judging by the respective numbers of cattle in the Union and here, there seems without other evidence a *prima facie* case for one or more such establishments north of the Limpopo. The following are the principal works:—The Farmers' Co-operative Meat Industries, Ltd., at Durban, Maritzburg, Harrismith, Klerksdorp and East London; the Smithfield Cold Storage & Export Co., at Johannesburg and Lourenco Marques; the Union Fresh Meat Co., Ltd., at Congella, Durban; Messrs. Sparks & Young, Durban; the Imperial Cold Storage & Supply Co., Ltd., Capetown; the Municipal Abattoirs, the Rand Cold Storage Co., Angehrns Cold Storage Co. and the Federal Cold Storage, all at Johannesburg; and Jeffries, Pretoria. In addition to these, there are two small factories at Okahandja and Karibib in South-West Africa. Should it one day be decided to establish meat freezing works in Southern

Rhodesia, then the information furnished elsewhere with regard to distances and outlets would no doubt enable those conversant with the technical problems of the trade to form some opinion as to the best methods to be adopted for preparing and conserving the products for transit to the coast and to the Congo, whether these should be carried in a chilled or frozen state, and what facilities must be provided for handling and conveying, storage and loading at the port. Judging from the known cost of erecting works elsewhere in South Africa at inland centres, it is estimated that the erection of a small factory with a capacity of 50 head per day and storage for about 4,000 quarters would at present prices cost about £35,000 to £40,000, according to design and site. On a basis of 100 head daily a cost of £70,000 to £75,000 is estimated. Sites of sufficient magnitude, say, 5 to 10 acres, adjacent to a railway could readily be secured, and a number have already been suggested providing more or less completely the requirements as to nearness to townships, railways, roads, water supplies, and at points having varying advantages in respect of access to the pastoral areas and to the coast. It must frankly be recognised that on the one hand the live transport of cattle entails cruelty, damage by bruising and fatigue, and loss of weight; on the other hand, transport of frozen or chilled meat requires rapid conveyance and suitable rolling stock, and in this climate involves some risk, and implies refrigerating plant and suitable chambers for chilling or freezing at the factory up country and at the port. If it is considered that frozen or chilled meat can be conveyed in good condition and at a commercial rate from points in Southern Rhodesia to Durban or Lourenco Marques, then advantage could be taken of existing cold storage and loading facilities on the wharfs at either of these ports. At Beira, which geographically is the natural port for export of Southern Rhodesian products, no such facilities are as yet to be found. It has been estimated that a frozen store of a capacity of 15,000 quarters there would cost in the neighbourhood of £40,000, including buildings and all equipment. It would be necessary further to provide insulated or refrigerator lighters to take the meat to the ships, as is the case at such great meat harbours as Montevideo and Gisborne, New Zealand, and elsewhere. There is a project for the construction of docks at Beira, and the position chosen for any stores should therefore be such that at some future date direct loading will be possible, as well as into lighters for the present.

Sites for Factories.—The question of establishing a cold storage in Southern Rhodesia has been fully discussed throughout the country during the past few months, and various centres were visited by the managing director of the Farmers' Co-operative Meat Industries and the managing director of the Smithfield Meat Company, and both these gentlemen indicated that their respective companies were prepared to extend their operations to Southern Rhodesia provided that the necessary capital was found from Rhodesia for the erection of works and the conduct of the business.

The amount of capital it is estimated would be required for a venture of this sort may be taken to amount to anything from £70,000 to £100,000. Enquiries have been made regarding sites at which works could be erected, and the townships of Salisbury, Bulawayo, Umtali,

Gwelo, Gatooma and Selukwe have all indicated their willingness to assist in every way possible and to provide the necessary sites and give every facility for successfully establishing such a works in their midst.

With regard to these centres, it might be advisable to give a brief outline of some of the features that present themselves as to the suitability or otherwise of the centres advocated.

Salisbury.—Is the administrative capital, and is on the main line of railways from Bulawayo to Beira, and possesses an important cattle market. It has the advantage of being near the Port of Beira. It would serve as a distributing centre for the branch lines running north of that point, also Gatooma, Gwelo and Bulawayo; but for the Congo trade it has the disadvantage of the extra distance to be traversed, and the same applies if the products of cold storage had to be despatched to ports in the Union, viz., Durban or Capetown. Land can be obtained there, and there is no doubt that the Municipality will offer every inducement for the establishment of a cold storage works. Water of good quality and in any quantity is available. The cost of coal for fuel would be 32s. 8d. per ton. No one can deny the fact that around this district many good cattle can be raised, but when it comes to the question of handling large numbers of cattle, these would have to be trucked to this point from considerable distances, as all the best ranching areas are far removed from this centre. Cattle would not be improved by being trucked or trekked to the works.

Umtali.—This centre possesses certain natural advantages, and will offer every inducement to the promoters of any freezing works. It is situated on the main line between Beira and Salisbury, and is the nearest point in Southern Rhodesia to that port. Umtali is a large depôt of the railway, and a good number of people are employed in the workshops. As a distributing centre it is far removed from the inland markets, and this would involve additional cost to get to Union ports or to the Congo. Coal for fuel would cost 41s. 5d. per ton at this point, and good water is available. So far as cattle supplies are concerned Umtali is far removed from most ranching centres, and is a long haul by truck and a long distance by road, but in a coastward direction. Odzi station in this neighbourhood has unique advantages in regard to situation, water, communications by road and rail, consideration of which led to the establishment of a canning factory there.

Bulawayo has certain advantages to offer as regards sites and geographical position. Three different localities here possess attractive features; one at Khambi has a specially plentiful supply of water. Fuel at this point is the cheapest of all the sites under review, viz., 21s. 3d. per ton. Bulawayo is a commercial centre of importance, and has the largest population in the Territory. It is also an important railway centre, and large railway engineering works have been erected, and factories are in course of construction. As a distributing centre, Bulawayo has a disadvantage so far as Beira is concerned, being the farthest away from this port of the sites under consideration. It has the advantage of being the nearest point to the Congo, and also to the Union. It has already established cattle markets with ample facilities for carrying on large stock sales. It should be also borne in mind that there is a possibility of the railway being built between Messina and

West Nicholson, which would bring Bulawayo in direct communication with Lourenco Marques, where there are large cold storage facilities available, and a much shorter rail journey than to any of the Union ports. The veld around Bulawayo is sweet, and several large ranches are within reasonable distance of this point. The Municipality is willing to assist any enterprise which would develop the meat industry.

Gatooma.—The Municipality of Gatooma is prepared to offer every facility for the establishment of a works at their township. Fuel at this point would cost 28s. 9d. per ton. The water question is rather a serious factor at the moment, but it is possible this may be improved at a later date. Gatooma would serve as a distributing centre for cold storage products for all points on the railway line, and is centrally situated for this. There is quite a large number of breeders in its immediate vicinity, but it is far removed from the larger ranches. It is the centre of quite a large mining industry, and within easy reach of Que Que, Shamva and other large mines.

Gwelo.—The Gwelo Municipality is also prepared to offer every inducement for the erection of a freezing works at this point. Water in plenty is available, and fuel at Gwelo would cost 25s. per ton. As a distributing centre, it is situated in the heart of the Territory so far as local needs are concerned, and is the junction of the branch lines to Selukwe and Victoria. It is situated on the main line between Bulawayo and Salisbury, and can supply the needs of both these towns as well as other towns situated on the line of railway. It is farther from the Union ports than Bulawayo, but nearer Beira. It is a large cattle centre, and has well-appointed sale yards. The immediate districts are large producers of cattle, and it is within easy distance of many of the large ranches, and cattle can be delivered there cheaply by either rail or road.

Selukwe.—So far as Selukwe is concerned, no site is available, but it is possible to purchase land from 12 to 15 miles from the railway, where good grazing and water would be available. The price of coal at Selukwe would be 26s. per ton, but transport to the site will have to be considered. Any site selected in this district would necessitate the building of a railway, which would add greatly to the initial cost, and would also further remove the works from the centre. Selukwe is not suitable as a distributing centre for the Territory, as the railway connections are not too good. Cattle in the district are available in large numbers, and could be delivered cheaply by rail or road.

Depressions in the cattle markets of this country and the Union of South Africa are likely to recur with frequency, and some means are becoming urgently necessary whereby breeders and farmers can be assured of regular sales of their surplus stock as they become available and at regular and steady values instead of at the present irregular and fluctuating prices. Every centre in the country is interested in this question, and the keenness of municipalities and village managements in offering land and water on reasonable terms and every facility for the establishment of freezing works points to the fact that the needs of the country are now realised, and it behoves those interested to lose no time in doing their utmost to bring the scheme to early fruition.

Fuel.—In regard to coal, the following particulars furnished by the general manager of the Wankie Colliery Co., Ltd., are of exceptional interest:—

"The coal is of a hard semi-bituminous variety. It is a coking coal, but not particularly free burning. It gives the best results when subjected to heavy draft, and on this account is probably the best locomotive coal in South Africa and one of the best coals for this purpose in the world. With regard to performance under ideal conditions, where the coal is crushed and fired by chain grate stokers and condensers are used in conjunction with the generating plant, I would refer you to the Shamva Mines' installation, where an evaporation efficiency of slightly over 11 (eleven) lbs. of water evaporated per lb. of coal burned is obtained month after month, a performance which is not equalled in any other part of South Africa. Some time ago we took eighty-three samples from all over the mine to get an average analysis. The result is as follows:—

Moisture	0.95
Volatile and organic matter	23.62
Fixed carbon	66.90
Ash	8.52
Calories	7159
B.T.U.	12887
E.P. in lbs. H ₂ O	13.33

"If industrial conditions get harder the price of coal must necessarily go up, but if these conditions become easier a reduction in price may be anticipated. The Colliery is handicapped at the moment by the insufficiency of railway transport. I understand that the Railways are obtaining further locomotives and more coal trucks; and we hope that when these arrive in the country the position will be much easier. At the moment we cannot supply the orders we are receiving, due to the inadequacy of transport."

The question of fuel for cold storage at any centre resolves itself into one of cost of coal at the particular point it is required at. The present prices f.o.r. at the undermentioned points are herewith given:—

At Wankie	12s. 0d. per ton of 2,000 lbs.
Bulawayo, Marvel or Khami	21s. 3d. " "
Gwelo	25s. 0d. " "
Selukwe	26s. 0d. " "
Gatooma	28s. 9d. " "
Salisbury	32s. 8d. " "
Umtali	41s. 5d. " "

Wood fuel is abundant and comparatively cheap in the country, being still largely used on many of the mines in competition with coal.

Labour.—The handling of meat and bye-products, the processes of chilling and freezing, packing and so forth require the services of highly skilled specialists, and no doubt such would have to be introduced from other countries, but mechanical engineers in connection with refrigerating plant, engines and machinery generally are readily obtainable in Rhodesia. No doubt also specially trained men would be necessary for subsidiary lines, such as tanning, soap boiling, fat extraction, but for buying and handling cattle local stockmen would be best. The great bulk of the work would be conducted by natives under white

supervision, and fortunately the question of an adequate supply of such labour need cause no apprehension. Natives are partial to handling cattle, and dealing with meat is attractive to them and they readily attain proficiency therein. The local native may go home more often than one from a distance, but usually returns to his former employment in which he attained some skill. It would not be difficult to obtain all the necessary native labour wherever works may be erected.

The Future of the Meat Industry in Southern Rhodesia.—It is not the intention here to propound a plan for conducting the future meat industry as distinct from the cattle industry of Southern Rhodesia; that is essentially a matter for those who have a knowledge of this highly specialised branch of manufacture, which is very distinct from cattle raising, and involves world-wide problems of technology, trade and distribution. Various quite distinct methods of finance and management have suggested themselves and to some extent already have been discussed, but ultimately commercial considerations by those who take up the business must decide all questions of ways as well as means. The necessary capital is the main consideration. It is possible that certain of the large packing firms, British, South African, Australian, American or cosmopolitan, may take up the business as an extension of existing activities elsewhere. A limited company or several such may embark on the meat packing business in Rhodesia, or the one existing company may be enlarged and reconstructed with this object. It is not beyond the possibilities even of individuals to establish meat works. Certainly the existence of alternative markets at different points and in competition might be advantageous to the grower.

In some quarters in Southern Rhodesia there is a laudable desire to develop the beef industry on co-operative lines, whereby the cattle owners and breeders should retain in their own hands the handling not only of the live stock but of the meat and bye-products as well, thereby securing the profits on the finished article and even on a retail scale. There seems to be some difference of opinion as to how far such a course is practicable, in view of the specialised nature of the freezing and canning industry to-day, with all its highly technical branches and the narrow margin of profit secured in other countries, the large profits being dependent upon the economic handling of large quantities but with only small turnover per head.

Perhaps the object of the farmers referred to might be met through taking up shares in any concern formed for the purpose, possibly defraying part of the cost by deductions from stock delivered in addition to shares subscribed for by the public in the usual way. A system, adopted in Australia, might also meet the desire of such stock owners, whereby meat freezing and packing factories undertake to handle live stock at a fixed tariff and dispose of it in accordance with the owners' wishes, handing to them the net proceeds of the transaction and enabling them thus at their own risk to secure the full profits of ultimate sale.

On whatever lines the meat trade of the country develops, the public interests can without difficulty be protected by legislation preventing undue monopolistic control and protecting the prime producer on the one hand and the ultimate consumer on the other, at the same time encouraging the industry in its legitimate operations and assisting in establishing the reputation of Rhodesian meat products in the markets of the world.

Conclusions.

SUMMARY.

The intention of this monograph has been in brief to furnish a description of the conditions of the cattle industry of Southern Rhodesia to-day, and to indicate the probable position in the early future, in order to prepare for the economic development which must ensue from the surplus of finished cattle annually available and from the steady increase of this supply beyond the present outlets. The leading factors in the situation have been dealt with and conditions described, advantages and drawbacks stated and figures furnished from reliable statistics and from the consensus of opinions of those intimate with the subject. It is hoped that the information so collected may be the means of arousing an interest in the commercial possibilities of a meat industry in Southern Rhodesia and of calling attention to the possibilities, leaving it to those, in the country or abroad, who are prepared to embark capital thereon to verify this comprehensive statement of the case for themselves if they so desire. The present is an opportune time for considering this matter before vested interests have arisen and at the critical moment when supply promises to exceed the present demands of markets reached by live animals or fresh meat.

Chapter I.—The area of Southern Rhodesia is 153,247 square miles, but in view of the existence of certain tsetse fly belts, this for practical purposes is reduced to 144,800 square miles for the present. In addition to the million and a half cattle of this country, any proposal for freezing works should also take into consideration cattle drawn from the neighbouring portions of the Transvaal, Bechuanaland and Northern Rhodesia, amounting at present to a further half million head, in all, two millions. Similarly for consumption, the needs not only of oversea and Rhodesian markets must be considered, but also the Belgian Congo, the Rand, Kimberley and Portuguese East Africa. As regards ease of access, it is to be noted that within 25 miles of the railways there are 33,090,000 acres of land; between 25 and 50 miles, 25,790,000 acres; and beyond 50 miles, the balance of 38,720,000 acres. The length of railways within the Territory is 1,167 miles, and the distance from the border at Umtali to the port of Beira, 204 miles; from Plumtree to Durban, 1,097 miles; from the southern border (Messina) to Lourenco Marques, 430 miles. The country is described as consisting largely of table-lands, well watered, generally amply provided with trees, and, as compared with even the best pastoral countries of the world, quite exceptionally favourably clothed with magnificent natural grass. The climatic conditions may be described in a word as very suitable for cattle, warm generally, but with frost in winter enough to be invigorating and health giving without impairing condition or injuring the pasturage. There is a season of abundance and of scarcity, but prolonged unseasonable droughts, such as occur in Australia, South Africa and parts of South America, are not recorded here. The eastern side of the country has perhaps excessive rainfall, and the western extremity tends towards aridity, but in neither part in an injurious measure, and the great bulk

of the country is situated happily in this respect between these two extremes. Of the total area of 98 million acres, native reserves cover $19\frac{1}{2}$ millions: over 45 millions are still unalienated, and of the remainder, privately owned by Europeans, 19 million acres are under beneficial occupation, and the rest, or about 14 million acres, is privately owned but not utilised.

It is not possible to generalise in regard to the price of land where there is so much, including areas of very different quality, from climatic, topographic, botanical, cultural and pastoral points of view, as well as of varying advantages as regards distance to markets, to the coast, to railways, as to water supplies, roads, population (white and native), and many other factors, which all are combined in the valuation of land. Suffice it then to say that, whilst fluctuations occur from three shillings to five pounds per acre, yet generally speaking cattle country fetches from five to ten shillings per acre.

Chapter II.—The number of cattle in Southern Rhodesia to-day may be taken for practical purposes at one and a half millions, and the net rate of increase at 12 per cent. on actual returns taken for a number of years, which compares very favourably with corresponding returns for other countries. To-day there is one beast to 65 acres, or, if the tsetse fly areas are excluded, one to just under 53 acres; whilst the stock carrying capacity of the country may be put down at from 10 to 12 acres to a beast, some farms already carrying one beast to 6 acres. There is thus great scope for expansion. The usual birth rate may be taken at 75 per cent., and the mortality of stock over one year at 4 per cent., and under that age at 5 per cent. The regular export of cattle, mainly of slaughter stock, began in 1916, and since that date has amounted to over 100,000 head, and for last year numbered 28,412 head, exclusive of breeding stock.

Chapter III.—The original cattle of the country consist of native breeds of good conformation, prolific and hardy, if somewhat light and slow maturing. Matabele, Mashona and Angoni all make good foundation stock for crossing with the many British breeds, rather too many, some think, that have been tried. There are now many grade cattle in the country, a term somewhat elastically employed, and nearly half the cattle are no longer purely native. Most European breeds seem to do well, and there is much rivalry between breeders, and a great variety of opinion as to which is best.

Chapter IV.—The methods of management in vogue vary from the extremely primitive to highly organised ranching, and to intensive dairying and stud breeding. Of late stall feeding in winter has made progress, and promises to become a feature of importance in the more purely arable districts, thus furnishing a welcome supply of artificially fattened meat of superior quality at a time when grass-fed beef is scarce. The system of trading consists mainly of sale by auction at certain centres, notably Bulawayo, Gwelo and Salisbury, and important export trade to Johannesburg has arisen during the past four years, though the distance and nature of the journey alike are very detrimental to the stock. Health conditions, though the subject of much anxious thought and constant discussion, are really very favourable, as contrasted with

those of other countries. Compulsory weekly dipping of cattle is universal, except in a few remote localities, which will ere long also be brought under the law, and to this to a very great extent the present healthy condition of the herds is attributable. There are to-day 1,639 dipping tanks in Southern Rhodesia, or upwards of one to every thousand head of cattle.

A well organised veterinary staff, distributed widely over the country, supervises the health of stock.

Chapter V.—Rhodesia, being a land of great distances, transport becomes a problem of the utmost importance in connection with any question of production on a large scale. Alive or dead, cattle constitute a concentrated but perishable commodity. The present outlets and modes of reaching them can only be regarded as provisional arrangements, useful for the present but impossible for the future, when really large quantities have to be expeditiously handled. The best means of transport from the backveld of Rhodesia to the world's markets overseas is essentially a problem for the manufacturer and distributor to determine through the study of geographical and commercial considerations, and having regard to distances, convenience of railage, facilities for storage and loading at coast ports, rates by land and sea, steamship routes and ultimate destinations. Such details as are available have been given above, but these and other points are in their very nature susceptible to alteration, and in a new country the non-existence of certain facilities only implies very frequently that there has not been sufficient justification for providing them as yet, not that there is any unsurmountable obstacle if need arises.

Chapter VI.—The cattle in Southern Rhodesia number to-day one and a half millions, of which it is estimated that 7 per cent. are disposed of annually, 75,000 being consumed locally and 32,000 exported. Local consumption is likely to increase slowly, hence the available surplus for export must increase from the present figure to upwards of 100,000 in 1924. During the past ten years the annual balance of trade has changed from a debit of £46,000 to a credit of £230,000. The principal foreign market is in the Union, which itself is a beef exporting country. Portuguese East Africa offers a limited outlet, whilst the potentialities of the Congo market, at present closed to Southern Rhodesia, are expected to become very important in the near future. The nearest port is Beira; Lourenço Marques and Durban are equidistant at present, but the latter could be brought nearer to the southern side of Rhodesia by certain railway connections.

The better class of cattle killed in the larger centres for white consumption run from 500 to 600 pounds dressed weight, and vary in age from four to eight years. The price for "prime" beef varies from 40s. to 50s. per 100 pounds dressed weight. "Mediums" and "compounds" fetch correspondingly lower prices.

Rhodesian beef has been exported overseas, and the best consignments have been most favourably commented upon. Recently shipments of rough goods have been despatched, but as yet no large parcels of good grade stock, such as is likely to constitute the large proportion of our regular exports in the future.

Chapter VII.—Existing outlets for Rhodesian beef are, as stated, limited. There is scope for improvement in the present abattoir system. A method of meat inspection will have to be introduced when beef is exported on a large scale. There are no freezing works in Southern Rhodesia, and only a few small cold storages. A number of packing factories exist in the Union, but they are too remote to be readily accessible to all parts of Southern Rhodesia. There is a meat canning factory at Odzi, at present temporarily closed down. The question of sites for factories has been discussed, and Bulawayo, Gwelo, Selukwe, Gatooma, Salisbury, Odzi and Umtali each advances a claim in this respect. Fuel and labour are plentiful and cheap. The precise lines on which the beef export trade of Southern Rhodesia will be built up cannot yet be forecasted, but so much seems clear to-day that an oversea trade for our better class stock must be sought, and for the rest, besides packing there is a steady outlet for sound beef of small size, native stock and so on, as compound meat on the mines of the Rand, Southern Rhodesia and the Congo.

Acknowledgments.—In the preparation of this memorandum the Committee have been assisted by a large number of individuals too numerous to mention, but to whom its thanks are now cordially tendered. Personal acknowledgment is, however, due for very special help and painstaking labours in this connection to the undermentioned:—

Director of Census, Union of South Africa; J. A. Wilson, Secretary, The Cattle Owners' Association of Rhodesia; K. Devik; Messrs. H. G. Mundy, B. Woods, J. S. Henkel, E. Philip, A. C. Jennings, C. L. Robertson and W. E. Meade; The Farmers' Co-operative Meat Industries, Ltd., of Maritzburg; Messrs. W. Bailie, Hume & Orr, B. Greenberg & Zacks, Ltd., Wm. Hepker & Co., and the Director of Abattoirs, Johannesburg, the Director of Agriculture, Mozambique Company Territory, the Chief Veterinary Surgeon, Portuguese East Africa, and the Secretary for Agriculture, Northern Rhodesia.

A questionnaire issued by the Committee to the farmers' associations throughout the country elicited much helpful information, for which acknowledgment is here made.

Southern Rhodesia Veterinary Report.

February, 1921.

AFRICAN COAST FEVER.

MAZOE DISTRICT.—One case occurred on the infected farm Sleamish.

MELSETTER DISTRICT.—Nine deaths occurred on the Tilbury Estate.

MATOBO DISTRICT.—A fresh outbreak occurred on the farm Vimbi, about 15 miles from the nearest infected centre. Two oxen died, and on enquiry it was found that these animals had strayed in December last, were released from the Plumtree Pound on 9th January, and in travelling back to Vimbi passed through the infected area. At the Sauerdale centre of infection the mortality was 13 head, and 120 at the Figtree centres.

ANTHRAX.

One ox died on the farm Burnleigh, Mazoe district.

QUARTER-EVIL.

The following mortality in cattle was reported:—Marandellas, 1; Salisbury, 2; Macheke, 2; Umvuma, 6; Victoria, 35; Umtali, 60; Melsetter, 26; Makoni, 30; Belingwe, 3; Plumtree, 10; Umzingwane, 10; West Nicholson, 3; Nyamandhlovu, 1; Bulawayo, 5; Inyati, 2.

CONTAGIOUS ABORTION OF CATTLE.

Three fresh outbreaks were reported.

THREE-DAYS SICKNESS OF CATTLE (Ephemeral Fever).

This disease was prevalent throughout the Territory. Except a few deaths in the Victoria district, the mortality was negligible.

SWEATING SICKNESS OF CALVES.

In the Salisbury and adjoining districts this affection was widespread. A few cases occurred in the Gwelo and Belingwe districts.

MYIASIS OF CATTLE (SCREW-WORM).

A very few cases reported. This affection seems to be disappearing.

HORSE-SICKNESS.

The following mortality in horses and mules was reported:—Gwelo, 3; Que Que, 1; Enkeldoorn, 3; Victoria, 1; Insiza, 3; Plumtree, 2; Nyamandhlovu, 1.

IMPORTATIONS.

From Union of South Africa:—Bulls, 22; cows, 42; horses, 3; goats, 265; sheep, 2,111.

EXPORTATIONS.

To Union of South Africa:—Slaughter oxen, 212; horse, 1. To Northern Rhodesia:—Horses, 6; donkeys, 61; pigs, 32. To Belgian Congo:—Sheep, 105. To Portuguese East Africa:—Slaughter cattle, 145; breeding cattle, 10; sheep, 50; horses, 3.

CORRECTION.—In the report for January, 1921, the number of cattle exported *via* Liebig's Drift should read 194.

March, 1921.

AFRICAN COAST FEVER.

MAZOE DISTRICT.—No cases have occurred on the infected area.

MELSETTER DISTRICT.—Nine deaths occurred on Tilbury Estate and two at Quagga's Hoek.

MATOBO DISTRICT.—No further cases have occurred on Vimbi or Sauerdale during the month. There were 19 deaths on Figtree section.

ANTHRAX.

One death reported from Burnleigh Farm, Shamva.

QUARTER-EVIL.

The following mortality in cattle was reported:—Salisbury, 3; Marandellas, 8; Gatooma, 21; Beatrice, 2; Belingwe, 1; Plumtree, 1; Essexvale, 8; West Nicholson, 7; Bulawayo, 1; Antelope, 3; Insiza, 1; Matobo, 18; Umtali, 9; Makoni, 34; Victoria, 153.

CONTAGIOUS ABORTION.

Six outbreaks were reported.

THREE-DAYS SICKNESS OF CATTLE (Ephemeral Fever).

This disease still continues to be prevalent throughout the country, but practically no deaths reported.

SWEATING SICKNESS.

Cases occurred in most districts except Melsetter, where it has not yet appeared. Twenty deaths were reported in Inyati district.

MYIASIS OF CATTLE (SCREW-WORM).

Five deaths have been recorded in Matabeleland from this affection.

HORSE-SICKNESS.

The following mortality was reported:—Bulawayo, 6; Plumtree, 4; Nyamandhlovu, 5; Lomagundi, 10; Gatooma, 2; Hartley, 1; Beatrice, 1; Bindura, 1; Mazoe, 3; Umtali, 1; Victoria, 4; Gwelo, 1; Umvuma, 1; Enkeldoorn, 1.

REDWATER AND GALL-SICKNESS.

These diseases have appeared in a considerable number of herds, and quite a number of deaths have been reported.

IMPORTATIONS.

From United Kingdom:—Bulls, 2. From Union of South Africa:—Bulls, 29; cows, 11; mares, 8; geldings, 4; mules, 16; sheep and goats, 2,096.

EXPORTATIONS.

To Union of South Africa:—Slaughter oxen, 170; breeding cattle, 1,138; pigs, 26. To Northern Rhodesia:—Sheep and goats, 185; donkeys, 36; pigs, 15. To Belgian Congo:—Sheep and goats, 35. To Portuguese East Africa:—Slaughter cattle, 24; breeding cattle, 55; horses, 2; pigs, 25.

April, 1921.

AFRICAN COAST FEVER.

No cases have been recorded from the Mazoe or Gwelo areas.

MELSETTER DISTRICT.—Fifty-one deaths occurred on the infected area at Tilbury Estate. No cases reported from Quagga's Hoek.

MATOBO DISTRICT.—Six deaths occurred at Plumtree centre. Nothing to report from Sauerdale and Vimbi areas.

ANTHRAX.

One case occurred at the infected area in Mtoko district.

QUARTER-EVIL.

The following mortality amongst cattle was reported:—Umtali, 33; Inyanga, 38; Melsetter, 32; Plumtree, 4; Essexvale, 11; West Nicholson, 9; Fort Usher, 5; Belingwe, 1; Gwelo, 1; Selukwe, 5; Victoria, 30; Beatrice, 9; Marandellas, 14; Gatooma, 35.

CONTAGIOUS ABORTION.

Two outbreaks are recorded.

SWEATING SICKNESS.

No cases reported.

HORSE-SICKNESS.

This season appears to be a bad one. The following mortality has been reported:—Gwelo, 1; Umvuma, 19; Selukwe, 2; Enkeldoorn, 4; Melsetter, 1; Plumtree, 16; West Nicholson, 2; Insiza, 1; Gwanda, 1; Makoni, 3; Inyanga, 1; Victoria, 8; Mrewa, 1; Bindura, 1; Mazoe, 1; Sinoia, 4; Gatooma, 4.

TUBERCULOSIS.

One imported bull re-acting to the tuberculin test was destroyed.

IMPORTATIONS.

From United Kingdom:—Bulls, 27; cows, 5. From the Union of South Africa:—Bulls, 57; cows, 28; donkeys, 138; mares, 39; geldings, 92; mules, 13; pigs, 8; sheep and goats, 2,316.

EXPORTATIONS.

To the Union of South Africa:—Slaughter cattle, 137; pigs, 24. To Northern Rhodesia:—Horses, 11; donkeys, 64; pigs, 9. To Belgian Congo:—Sheep and goats, 320; horse, 1; mules, 2; donkeys, 99; pigs, 62. To Portuguese East Africa:—Slaughter cattle, 165; breeding cattle, 105; horses, 4; mules, 4; donkeys, 2; pigs, 16.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Weather Bureau.

RAINFALL.

STATION.	1921.		Seasonal to 30th April.
	March.	April.	
MASHONALAND :			
Bikita—			
Angus Ranch	4.65	2.01	21.83
Bikita	14.33	7.54	53.52
Charter—			
Buhera	3.49	0.70	20.37
Bushy Park	7.21	1.61	31.73
Enkeldoorn Gaol	5.21	2.53	29.69
Marshbrook	2.80	0.67	30.11
Range	5.15	6.61	36.07
Riversdale	3.57	0.76	24.61
Umniati	6.95	0.45	28.92
Vrede	6.23	1.41	31.25
Chibi—			
Chibi	5.52	2.92	21.75
Chilimanzi—			
Central Estates	6.79	2.36	31.82
Chilimanzi	8.15	2.08	23.63
Driefontein	7.84	1.76	20.86
Felixburg	5.94	0.77	25.57
Grootfontein	5.65	1.09	23.76
Induna Farm	9.38	0.78	30.30
Wylde Grove	4.30	2.08	25.64
Darwin—			
Mount Darwin	7.63	1.27	30.55
Gutu—			
Eagle's Nest Rancho	6.27	2.30	22.31
Glenary	3.01	0.77	23.33
Gutu	9.18	1.06	31.75
M'vimvi Rancho	8.53	1.67	27.72
Hartley—			
Ardgowan	6.49	0.81	37.94
Carnock	7.81	0.50	32.48
Cringleford	3.91	0.23	38.29

RAINFALL—(Continued).

STATION	1921.		Seasonal to 30th April.
	March.	April.	
MASHONALAND—(Continued)			
Hartley—continued			
Cromdale (n.s.)	5.49	0.60	—
Elvington	5.15	1.42	32.86
Gatooma	9.84	1.34	39.79
Gowerlands	7.27	0.70	32.76
Hallingbury	8.77	1.28	—
Hartley Gaol	6.41	0.41	35.32
Jeninstown	4.55	1.27	34.50
Hopewell	5.58	0.23	35.52
Pollockshields (n.s.)	3.86	0.78	—
Ranwick	7.66	1.15	40.16
Spitzkop	6.52	0.56	31.68
Umsweswe (n.s.)	4.82	0.81	—
Inyanga—			
Inyanga	6.51	1.72	34.14
Rhodes Estate	11.04	0.90	—
St. Trias' Hill	8.83	2.94	33.16
York Farm	11.37	2.61	41.90
Lomagundi—			
Argyle	4.85	0.59	30.95
Darwendale	5.12	1.38	37.74
Duxbury Farm	2.78	1.53	24.41
Gambuli (Mukore)	4.28	0.73	29.80
Lone Cow Estate	7.08	1.04	36.86
Maningwa	5.86	0.84	29.55
Mpandaguta	6.95	3.31	35.91
Mukwe River Rancho	3.83	2.23	28.75
M'Vaami Farm	4.87	0.70	32.95
Palm Tree Farm	5.97	1.65	28.79
Nyarora (n.s.)	3.07	0.66	—
Mrindagomo (n.s.)	7.58	1.00	—
Sipolilo	3.94	3.25	27.42
Talfourd	2.07	1.57	26.05
Makoni—			
Carlow Farm	3.21	2.39	26.76
Chitora	5.26	2.03	27.71
Craigendoran	7.56	1.61	24.44
Eagle's Nest Rancho	4.87	2.95	30.56
Forest Hill	3.44	1.14	24.39
Gorubi Springs	7.36	2.07	29.36
Mona	3.65	2.90	28.10
Monte Cassino Mission	5.91	1.45	30.44
Wensleydale (n.s.)	2.94	1.44	—
Marandellas—			
Land Settlement Farm	2.53	2.84	28.83
Lendy Estates	7.09	1.92	40.46
Marandellas	5.16	0.94	28.74
Nelson	4.34	0.57	23.65
Igudu	5.05	1.91	28.88
De-Ita	5.52	1.40	32.84

RAINFALL (*Continued*).

STATION	1921.		Seasonal to 30th April.
	March.	April.	
MASHONALAND—(Continued)			
Mazoe—			
Bindura	6.15	3.00	31.26
Ceres	11.24	2.56	34.35
Citrus Estate	8.45	1.53	36.19
Craigengower	6.80	0.53	27.67
Dundry	4.48	2.55	—
Kingston	7.99	2.96	37.68
Marston Farm (n.s.)	5.06	3.55	—
Mazoe	10.18	0.80	36.09
Mazoe Dam	8.19	1.18	34.15
Omeath	7.64	1.14	28.02
Rustington	7.48	1.58	25.88
Ruoko Ranche	7.33	1.82	34.56
Shamva	10.09	0.93	28.61
Stanley Kop	7.47	0.71	28.38
Sunnyside	8.33	2.18	35.49
Teign	8.27	0.59	29.68
Virginia	8.72	0.60	31.21
Zombi Farm (n.s.)	8.08	0.80	—
Melsetter—			
Brackenbury	11.93	5.55	51.90
Chitora	12.28	5.71	39.58
Helvetia	14.07	6.56	55.18
Chipinga	14.89	6.30	41.06
Melsetter	6.83	4.12	37.51
Mount Selinda	14.23	9.81	56.46
Tom's Hope	13.41	4.50	46.31
Vermont	15.42	8.59	57.34
Mrewa—			
Mrewa	8.27	2.66	36.73
Selous Nek	2.74	2.74	37.55
Mtoko—			
Makaha	5.46	3.34	31.38
Mtoko	1.25	2.04	27.11
Ndanga—			
Doornfontein	3.51	1.64	23.94
Ndanga	8.62	3.11	33.43
Salisbury—			
Avondale	5.44	1.10	32.98
Borrowdale (Hatcliffe)	6.16	4.59	38.60
Botanical Experiment Station	6.51	0.73	31.40
Bromley	5.55	1.51	27.15
Chishawasha	6.37	2.91	36.11
Cleveland Reservoir	7.43	1.39	36.11
Glenara	9.52	1.60	32.37
Goromonzi	8.28	2.45	34.81
Gwebi	4.92	1.09	25.05
Hillside	5.80	1.06	27.39
Meadows (The)	12.20	1.59	39.59
Salisbury (Railway)	7.18	0.53	32.76

RAINFALL (*Continued*).

STATION	1921.		Seasonal to 30th April.
	March.	April.	
MASHONALAND—(Continued)			
Salisbury—continued			
Sebastopol	9.33	1.46	28.91
Selby	9.87	1.42	32.01
Stapleford	8.16	2.55	40.81
Tisbury (W. Commonage)	7.51	1.40	31.20
Umtali—			
Chiconga	3.59	1.50	—
Hoboken	14.05	2.01	51.70
Gilmerton	6.46	1.56	23.50
Mutumbara Mission	2.71	2.02	16.57
Odzani River (Power Station)	4.22	4.82	31.95
Odzi Drift	3.63	1.99	21.39
Premier Estate	4.41	1.36	23.13
Sarum	3.40	0.88	—
Stapleford	16.28	3.66	54.99
Stralsrund	3.40	1.76	27.31
Umtali (Gaol)	4.71	1.77	21.14
Utopia	4.45	0.76	—
Victoria—			
Brucehame	4.11	2.14	25.64
Clipsham	5.23	1.68	27.40
Cavan	6.18	1.23	—
Gokomere Mission	5.26	0.94	25.86
Jichidza Mission	11.38	4.28	42.90
Makorsi River Rancho	6.45	5.05	33.65
Morgenster Mission	6.89	5.65	39.23
Riverdene North	3.99	1.50	22.61
Silver Oaks	5.12	1.51	22.40
Stanmore	4.32	0.78	17.56
Summerton	5.73	0.75	22.58
Victoria	4.93	0.89	22.42
MATABELELAND :			
Belingwe—			
Belingwe	1.70	1.36	26.31
Bickwell	3.41	0.90	24.43
Bubje Rancho	7.12	0.82	20.15
Tamba	4.95	1.07	—
Bubi—			
Imbesu Kraal	5.45	0.08	28.50
Inyati	8.24	0.82	—
Maxim Hill	6.36	0.47	27.27
Shangani Estates	4.46	0.44	30.73
Bulalima-Mangwe—			
Empandeni	4.40	0.61	26.53
Garth	4.68	1.03	34.40
Kalaka Farm	4.03	0.65	25.26
Retreat	8.69	0.21	31.65

RAINFALL (*Continued.*)

STATION.	1921.		Seasonal to 30th April.
	March.	April.	
MATABELELAND—(Continued)			
Bulalima-Mangwe—continued			
Riverbank Farm	5·90	0·01	29·27
Solusi Mission	4·60	0·07	29·47
Tjankwa	4·68	Nil	29·83
Tjompanie	5·71	0·04	29·80
Bulawayo—			
Keendale	6·63	0·92	29·05
Lower Rangemore	5·53	0·41	26·07
Observatory	5·12	0·06	26·21
Paddy's Valley (n.s.)	5·64	0·02	—
Gwanda—			
Gwanda (Gaol)	4·94	1·15	24·70
Mtshabezi Mission	8·52	0·33	21·08
Gwelo—			
Cross Roads Farm	9·14	0·77	29·46
Dawn	5·79	2·33	31·32
Globe and Phoenix Mine	9·05	0·08	31·22
Hunter's Road	10·16	1·65	33·30
Lover's Walk	6·70	1·70	33·57
Oaklands	11·94	3·07	39·37
Partridge Farm	9·58	2·12	33·57
Rhodesdale Rancho	8·24	1·25	27·77
Riverdale	7·00	2·58	26·88
Sikombela Farm	10·41	0·27	37·32
Somerset Estate	8·81	0·35	30·58
Woodendhove	7·03	1·96	25·47
Insiza—			
Albany	5·97	1·18	27·10
Filabusi	9·33	0·19	30·76
Infiningwe	5·27	0·96	28·26
Inyezi Farm	7·07	1·58	23·66
Orangedale	5·27	2·65	32·31
Matobo—			
Holly's Hope	6·23	0·50	18·17
Matopo Mission	6·73	1·08	30·00
Sebungwe—			
Gokwe	8·29	0·35	39·30
Selukwe—			
Hillingdon	10·39	1·55	28·93
Selukwe (Railway)	9·32	2·88	45·72
Rio	10·39	1·01	33·68
Umzingwane—			
Essexvale	8·53	1·30	29·31
Wankie—			
Guvo	5·18	0·09	19·21
Lynwood Estate	9·30	0·57	34·89
Matetsi (Railway)	7·66	Nil	22·53
Ngamo (Railway)	9·17	0·63	29·76
Waterford	6·14	Nil	22·42
Wankie Hospital	4·19	1·07	22·84

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 106. Cultivation and Preparation of Ginger.
- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.

- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 382. Annual Report of Experiments. Experiment Station, Salisbury, 1919-1920.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
 No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
 No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
 No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
 No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
 No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
 No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
 Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
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The Analyses of Agricultural Products, Soils, Water, etc.
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Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 156 of 1921.]

[25th March, 1921.

WATER ORDINANCE, 1913.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following applications have been made for authority to use water:—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
The Mashaba Transport and Trading Company	White Spruit	Victoria	Farm Balmain
Dora Tongue	Umgusa	Bulawayo	Farm sub-division "E." Umvutcha

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 181 of 1921.]

[8th April, 1921.

WATER ORDINANCE, 1913.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant	From what river	Native district of	For the purpose irrigating a certain portion or portions of the
C. W. Worswick ...	Nyacom-beri	Maran-dellas	Farms Weir, Argosy and Dormervale

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 229 of 1921.]

[29th April, 1921.

ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 576 of 1920, and, in terms of section 17 of Government Notice No. 21 of 1917 declare the following areas of infection and guard areas in lieu thereof :—

MATOPO NATIVE DISTRICT.

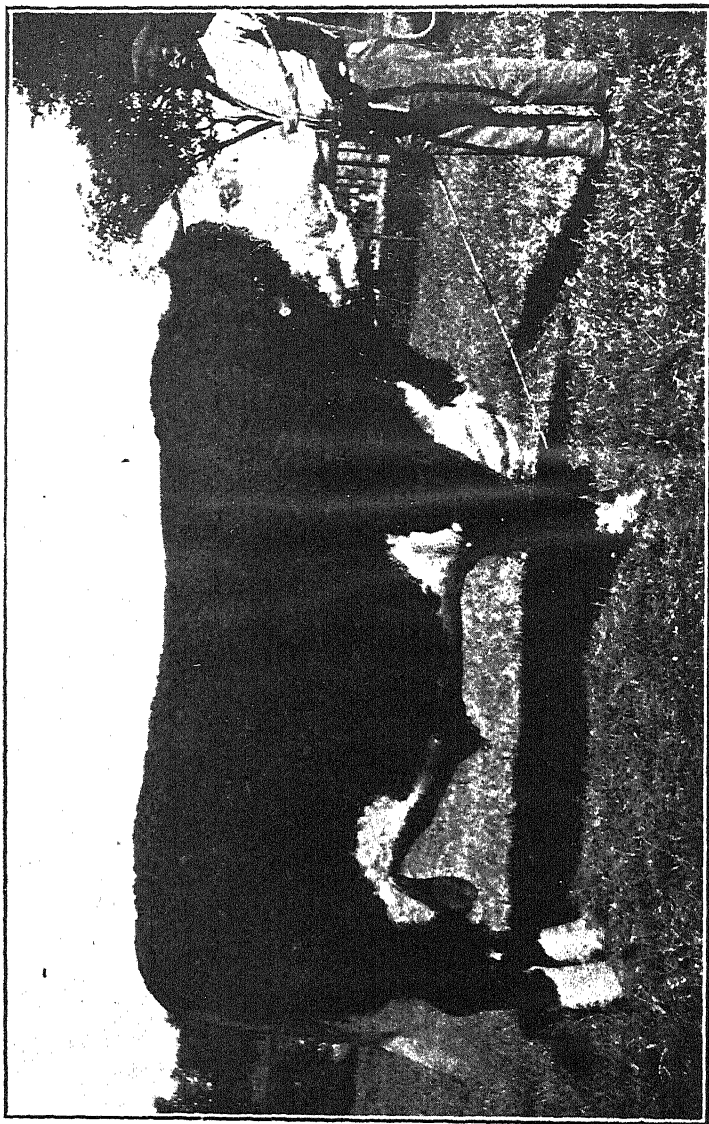
(a) *Areas of Infection.*

1. The farm Umhlonyeni
2. An area bounded by and including the farms Shashani, Driefontein, that part of the Matopo Mountains lying west of the Ove River, Mount Edgecombe, Famookwe, Mount Francis and Mauwe.
3. The farms Vimbi, Holi, Luma, Natisa, Lana and Umfula.

BULAWAYO, MATOPO, BULALIMA-MANGWE AND UMZINGWANE NATIVE DISTRICTS.

(b) *Guard Areas.*

1. The Sauerdale Estate (excluding the fenced portion of Westacre Creek farm) and that portion of the farm Bellevue belonging to the Chabalala Cattle Syndicate.
2. An area bounded by and including the farms Hannayvale, Sargents, Springvale A & B, D'Hoop, Forwards, Matopo Mountains west of the Matopo Reserve, Manyoni, Sibuntuli, Toko North, Toko No. 2, Damara, Impondwene, Dope, Pudzo, Babuli, Rosenfels, Shashani Reserve, Reserve, Taylors, Smiths, Vlakfontein, Mali, Beaconsfield and Darnaway.



"Devonby Damocles," winner of 1,000 guineas trophy, Bulawayo Show,
1921. Owner Mr. C. S. Jobling.



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AUGUST, 1921.

[No. 4.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Maize Estimate.—The final forecast of the maize crop for the season 1920-1921 for the Territory is 1,120,000 bags of 203 lbs., which is precisely last year's crop. The actual figures resulting from a calculation of the average of the forecasts sent in for each district is 1,112,000 bags. There are good reasons for believing, however, that many of the forecasts sent in are too conservative. The districts from which forecasts were received in excess of the previous season's yield are:—Bulawayo, Nyamandhlovu, Darwin, Lomagundi, portions of Mazoe and Marandellas, Melsetter and portions of Salisbury and Umtali districts. The remainder of the estimates are either equal to or below the previous season's yield, the poorest estimates being for Gwelo, Insiza, Makoni and Victoria districts. Lower estimates than the yield for 1919-1920 do not in all cases point to a poorer season than usual, but rather indicate that more land is being devoted to crops other than maize—chiefly tobacco.

A Primary School of Agriculture.—In the course of debates in the Legislative Council the subject was raised of the future use of the Westacre Farm, part of the Rhodes Matopo Estate, which, through the lamented death of Mr. Hull, has now reverted to the Government. The Director of Agriculture explained that it was the intention of the Government to establish there a Primary School of Agriculture, provided that sufficient funds for the necessary initial outlay were forthcoming from the proposed loan of £150,000 for expenditure on various public purposes. If these necessary funds were found it was the intention to use for this purpose a portion of the Westacre Farm, extending over 3,000 acres and including the existing homestead and a portion of the irrigated area, the orchard and dry arable land.

It is not feasible to establish a School of Agriculture on the lines of such establishments in the south, but it is hoped at the Matopos to provide a general education with a view to preparing boys to be managers or to take up subordinate posts on ranches and farms, thus giving an opening in rural life to youths without capital sufficient to take up farms at once on their own account.

The lack of facilities for imparting tuition of this kind has been apparent for some years, and the Education Department has endeavoured to fill the gap. The late Mr. George Duthie was specially interested in the matter, as is his successor, but lack of funds has prevented it taking definite shape. Should the loan materialise, the project can be realised at once.

The Salisbury Show.—The Salisbury Show to be held on the 16th, 17th and 18th August will this year be officially opened by H.R.H. Prince Arthur of Connaught. The cattle entries are greater in number than ever before, and the sale of pedigree and well graded stock on the second day presents an opportunity not to be missed by all those anxious to improve their herds. The maize exhibits promise to excel both in number and quality those of last year, whilst in addition there is expected to be keen competition in the wheat, tobacco, fruit and poultry classes. Silver trophies have been presented by Messrs. Lovell and Christmas, Ltd., West Smithfield, London, for competition in the butter, cheese, ham and bacon classes, the exhibits in the first two instances to be packed suitable for export.

As in past years, the third day of the show will be devoted to meetings, lectures and demonstrations of an instructive character, a feature peculiar to Salisbury amongst all South African shows, and one which has proved a marked success. This year it is proposed that in the forenoon there will an address on Friesland cattle by Mr. James Woodin, Secretary of the Friesland Cattle Breeders' Association of South Africa, which will be followed by demonstrations on prize winners of all breeds by the judges, after which Mr. St. C. B. Gwynn will deal with the present critical position of the cattle industry. In the afternoon there will be meetings in regard to maize, tobacco and trout acclimatisation. Demonstrations will also be given in the produce and poultry sections, whilst tillage implements in operation will form another attractive feature.

Friesland Cattle for Rhodesia.—The Friesland Cattle Breeders' Association of South Africa are sending sixteen registered Friesland stud animals for exhibition at the forthcoming Salisbury show and subsequent sale. A condition of sale is that an animal shall not be transferred to anyone outside of Southern Rhodesia for a period of five years. The consignment consists of bulls and females from the herds of the following well-known breeders:—Messrs. Orpen & Son, of Avoca, New England; Mr. Elton Mills, of Mimosa, Queenstown; Messrs. Frasers, Ltd., of Wepener; Mr. W. H. Bartlett, of Queenstown; Mr. C. W. Vermaak, of Helpmakaar, Natal; Mr. Harold Blore, of Rivenhill, Ficksburg, O.F.S.; Mr. Julian B. Ehrlich, of The Retreat, Bloemfontein; Mr. Arthur Kingwill, of Graaff-Reinet; Mr. H. Cloete, Bedford; Mr. J. D. van Niekerk, Brakfontein, Bedford; Mr. W. J. B. Stone, of Underberg, Natal; Mr. W. Evans, Melrose, Bedford; and Mr. D. P. Bennett, of Standerton. The animals have been carefully selected with a view to meeting Rhodesian conditions, and are the progeny of some of the best blood in the Union. A unique opportunity therefore presents itself of procuring advantageously stock of undoubted quality, and it should not be missed. The Friesland Association are adopting a far-sighted policy in thus advertising their breed, and we feel sure their action will be greatly appreciated by the farming community.

A Milk Recording Scheme for Rhodesia.—The progress of the dairy industry in this country depends primarily upon increasing the milk production of our cows. To this end there has been formulated the system of milk recording. Every dairy country has adopted some scheme embodying the weighing and testing of milk produced by individual cows, and it will be remembered that Mr. Trevor Williams, the President of the British Friesland Breeders' Society, during his recent visit to the Union, strongly emphasised the necessity for a more universal system of keeping milk records. The advantages of milk records are obvious. They enable the farmer to weed out unprofitable cows and put his dairying operations on a definite business basis. An extract from the Journal of the British Ministry of Agriculture bearing on this subject is of interest:—"It is evidence of the farmers' recognition of the practical value of milk recording that whilst only 640 certificates were applied for in 1916, the number applied for in 1920 was nearly 18,000. These certificates have had a remarkable effect on the prices realised at sales of recorded cows. As much as £285 was paid last year for a *non-pedigree* cow with an officially certified milk record. By keeping milk records, the farmer knows just what the cows are yielding, and can ensure that he keeps no cow that does not earn her keep."

It is hoped to encourage milk recording amongst farmers in Rhodesia by devoting a page or more in each issue of this *Journal* to records which are being put up by Rhodesian dairy cows. The outlay entailed in carrying out such a scheme is extremely small when compared to the advantages accruing from it. The only apparatus required is a milk scale and a Babcock tester, both of which can be purchased for approximately £5, and these, if properly handled, will last a lifetime.

In the next issue of the *Journal* full particulars as to the keeping of records and the testing of milk will appear, and it is hoped that dairy farmers throughout the Territory will support the scheme.

Agricultural Lectures.—Following on the procedure of previous years, a short course of lectures on agriculture will be held in the High Court, Salisbury, commencing on the 22nd August and terminating on the 10th September. Whilst the time allocated is all too short to give the amount of instruction desirable, yet it is realised that persons engaged on the land find difficulty in absenting themselves for longer, and the period has been selected with a view to interfering as little as may be with farming operations.

The courses are open to men and women and no fees will be charged. To overcome difficulties of distance, return second-class railway fare will be refunded to all those resident at a distance from Salisbury who attend the entire course. Students must make their own arrangements for accommodation, but if advised of their needs, bookings at suitable hotels or boarding houses will be made on their behalf. For those who bring their own camping outfit, tents will be provided at a convenient spot near to the lecture hall, but notice of intention to make use of these facilities should be given in advance.

To utilise the time to the utmost, it has been arranged to hold evening lectures and debates as well, but these will be of a more popular nature, and occasionally enlivened by entertainments. The subjects to be dealt with will be as follows:—Live Stock and Dairying; Veterinary Science; Farm Management; Maize; Forage Crops; Oil and Fibre and Miscellaneous Crops; Tobacco; Fruit Trees and Tree Planting; Farm Engineering; Agricultural Chemistry, and Engineering. A daily series of interesting excursions and demonstrations has also been arranged.

Those desirous of attending the course should notify the Director of Agriculture, Salisbury, at an early date, and indicate what arrangements, if any, they desire to be made on their behalf in regard to accommodation.

Trout.—A movement is on foot for the introduction of trout into the rivers of Southern Rhodesia on a larger and more systematic scale than has hitherto been attempted, and a considerable measure of success has attended the preliminary efforts in this direction. The essential means for this purpose have been provided through the action of an anonymous benefactor, who has given a number of trout hatching boxes for distribution, and has since further donated £100 against a similar amount voted by Government.

Simultaneously and unconsciously of the intention of each other, trout acclimatisation societies have been formed at Salisbury and Selukwe respectively, the former, however, embracing a membership extending from Bulawayo to Umtali, from which latter town a score of members are drawn. Having the same object in view, it is sincerely

to be hoped that one body for the whole country will be created to carry out the necessary functions of procuring and distributing ova, disseminating advice and information, distributing hatching boxes, and financially assisting in the propagation and introduction of trout to our streams and lakes. In time perhaps it will be possible to establish a hatchery within the country, and so overcome the chief difficulty so far experienced—the provision of ova. Ultimately no doubt the protection of trout and of the interests of riparian owners and anglers will have to be dealt with, legislation evoked, pisciculturists and bailiffs employed. The facilities for sport should also be made known as a material attraction to the country.

Meantime, however, the Southern Rhodesia Trout Acclimatisation Society proposes to undertake the initial spade work, and to enlist the sympathy of all disposed to support its aims and efforts. A meeting of the Society will be held in the Salisbury Agricultural Showground on Friday, 19th August, to which all interested are cordially invited. It will be of material assistance if persons desirous of joining will give their names to the honorary secretary, Mr. W. P. Maytham, P.O. Box 11, Salisbury.

Experiment Farm at Bulawayo.—An agricultural experiment station will shortly be opened at Bulawayo. A portion of the municipal farm has been allotted for this purpose, and the station will be run as part of the municipal farming operations, but under the guidance of the Department of Agriculture. To a considerable extent the trials conducted at the Salisbury experiment station will be repeated at Bulawayo, the object being to ascertain in what measure the results obtained hold good there. The public spirit which has prompted the Bulawayo municipal authorities to allot this land is highly commendable, and we trust that results of great benefit to the farming community of Matabeleland will accrue.

Veld Fires.—Grass fires are likely to occur at this time of the year, and it is necessary to take every possible precaution to counteract the danger. The Department of Agriculture last year issued a notice, printed in four languages, on the subject, and this has again been distributed throughout the country. In this notice the public are reminded that any person who without lawful authority sets alight trees, bush or grass not his property, is liable to heavy penalties, and may also be called upon to pay for the damage caused. Attention is also drawn to the fact that before proceeding to burn standing or growing herbage, grass or bush upon his land, a person must give reasonable notice to adjoining occupiers of his intention to burn. All fires lawfully lit on the land of another, or on roads, outspans or vacant land, must be properly controlled and carefully extinguished before leaving. Servants acting under orders or employers directing them are equally liable for any contravention of the Herbage Preservation Ordinance.

Once a fire is beyond control, enormous damage may be done. Farmers realise this, and in the last few years much has been done by mutual effort to combat the danger.

The late Mr. George Duthie.—By the death of Mr. George Duthie on 14th June the farming community has lost one of its most active members. Although he only commenced farming himself in 1917, yet he soon took a prominent part, especially in connection with the formation of the Maize Growers' Association, to the interests of which he devoted himself zealously, sparing neither time nor labour, and arousing public enthusiasm in a way few could have done and none surpassed. For many years Director of Education, he possessed a wide knowledge of Southern Rhodesia, and he was responsible in great measure for establishing the educational system on sound lines. He took a keen interest in public affairs, and by pen and speech did his utmost to promote the good of the country. A man of high culture and intellectual ability, he was connected with many and varied interests, and was by his kindly manner and quick wit deservedly popular amongst a very large circle of friends, by whom he will be affectionately and gratefully remembered.

Tobacco.

It is pleasing to note that the quantity of leaf handled by the Rhodesian Tobacco Co-operative Society last year establishes a record. From the records available, the 1912-1913 crop handled by the Warehouse was 1,977,086 lbs., whilst the figures for this past season are as follows:—

	lbs.
Virginian leaf handled and graded	1,263,398
Virginian leaf handled and farm graded ...	513,347
Virginian leaf handled but not graded	171,325
Total Virginian leaf	1,948,070
Turkish tobacco handled and sold	73,452
Total	2,021,522
The crop for the previous year totalled	878,647

The increased quantity handled and controlled by the Society being 1,142,875
a very substantial increase for one season.

It will be of interest to know that of this quantity Mr. M. Pevsner purchased Virginian and Turkish together approximately 1,214,325 lbs., and the United Tobacco Company 807,197 lbs.

Statistics of Live Stock and Animal Produce for the Year 1920.

By H. C. K. FENN, Acting Statistician.

Taking a broad survey of the live stock situation in this Territory, cattle occupy the premier position, while the numbers of small stock of all sorts are comparatively insignificant.

In spite of various setbacks due to diseases, which have been responsible for losses in a few isolated instances but which are being effectively overcome by careful quarantine measures and improved methods of treatment, the rearing of cattle in this country is so successful that it seems destined in the not distant future to hold the leading place in Southern Rhodesian industries.

Horses as well as mules are being imported on a larger scale than has been hitherto possible, due in a great measure to the promising success attained in immunising them to horse-sickness—a factor which has militated in the past against the acquisition of unsalted horses by farmers in the outlying districts.

The rearing of sheep and goats is by the few who attempt it a subsidiary industry to that of cattle rearing. The former have decreased in numbers during the year. It will be some years, and probably not until the coarse, profusely seeding grass is fed down and gives place to the short, sweeter varieties, that woolled sheep will be common in all parts. The seed of the "assegai" grass, which is caught in the wool and penetrates the skin and flesh and finally causes the animal to succumb to acute inflammation, is the main cause of the trouble. The straight-haired native breeds and the Persian do not suffer in the same way.

Pig raising also shows a marked improvement. Pedigree imported boars have amply repaid their cost through the ready sale of their progeny. It has been found practicable to fatten pigs for slaughter on vegetable produce of the farm without having to rely on skim milk, whilst the low price of maize has stimulated its conversion into pork.

Before proceeding to deal with the figures given in the attached tabular statements, mention should be made of the indications of an increasing appreciation on the part of stockowners generally of the utility of reliable statistics of live stock. The returns from all parts of the country came in quite satisfactorily during the first quarter of this year. On 14th March, however, it was considered advisable to despatch 379 circulars calling attention to the non-receipt of returns. The response was most satisfactory. Although a few more returns

came in at the last moment as a result of urgent messages, the small number outstanding on 1st June could be accounted for through the absence from the country of sundry farmers, farms having changed hands and so on. It is felt, however, that the statistics of live stock to be of greater public interest and utility should be ready for publication certainly not later than April following the year for which the returns are rendered. To this end an appeal is once more made to all stockowners for the early preparation and prompt despatch to this office of their live stock statistics, and in cases where the stockowner contemplates being absent from the Territory on holiday or business at the end of the year, to arrange with his manager or the person left in charge to attend to this important matter at the proper time. Unless otherwise advised, the statistical forms are despatched from this office addressed to the farm owner personally, and should the addressee happen to be away from home, the envelope containing the forms is often either sent to his new address or is pigeon-holed pending his return. It is largely owing to lack of proper arrangement in such cases that the returns are delayed or are not forthcoming.

During the past few months a return was prepared by direction in this office showing the ownership of land in Southern Rhodesia. The surveyed land devoted to cattle raising is given as at 1st January, 1921, at 18,854,977 acres, and the unsurveyed at about 1,000,000 acres. This divided by the total number of European-owned cattle at that date gives 25.6 acres per beast. Great assistance in this connection has been given by certain company managers holding blocks of land in furnishing the statistical office with statements showing the extent of occupied land, also particulars of sub-divisions of farms and the names and addresses of their tenants, and it would be a favour and of much assistance if others would do likewise.

The following table shows the increase or decrease as the case may be of all kinds of European-owned live stock during the year ended 31st December, 1920:—

	1919.	1920.	Plus Difference.	Per- centage Plus.	Minus Difference.	Per- centage Minus.
Cattle ...	678,508	772,891	94,383	13.9	...	...
Horses ...	1,967	2,891	924	46.9	...	...
Mules ...	1,864	2,496	632	33.9	...	...
Donkeys ...	8,402	9,116	714	8.4	...	...
Sheep ...	44,257	43,844	...	...	413	.9
Goats ...	18,390	19,455	1,065	5.7	...	...
Pigs ...	14,585	17,761	3,176	21.7	...	...
Poultry ...	100,449	109,394	8,945	8.9	...	...

It will be seen that all classes of stock increased during the year—except sheep, which decreased as a result of the ravages of wild carnivora and the abnormally wet weather experienced towards the end of the year. For the same reasons, native-owned sheep and goats showed a considerable diminution in numbers compared with 1919.

The total of European-owned cattle at 31st December, 1920, was 772,891, added to 744,402 native-owned cattle as estimated by the Native Department, giving a total of 1,517,293 head in the Territory, or one beast to 64.6 acres. From a glance at the attached table it will be seen that the native-owned cattle have increased from 652,776 in 1919 to 744,402 in 1920, or 14 per cent., as against 678,508 in 1919 to 772,891 in 1920, or 13.9 per cent. for European-owned cattle. Every year since 1914 the rate of increase in European-owned cattle has exceeded that of the native-owned cattle, but owing to more reliable information obtained largely through dipping returns, it has now become possible for the Native Department to ascertain more accurately than in the past the number of native-owned cattle. The number was evidently under-estimated in the past and is now more accurate and agrees with that for European-owned stock.

The total figures and the rate of increase of European and native cattle and both together for the past few years show a high level and singular steadiness compared to corresponding figures for other countries, and now that the source of error in the native figures is disappearing, even greater regularity may be looked for.

INCREASE OF CATTLE, 1915 TO 1920.

Year.	European-owned Cattle.	Native-owned Cattle.	Total Cattle.	European Cattle. Net annual increase, per cent.	Native Cattle. Net annual increase, per cent.	All Cattle. Net annual increase, per cent.
1915	394,856	446,060	840,916	...	...	...
1916	468,504	491,522	960,026	18.6	10.1	14.1
1917	532,311	551,632	1,083,943	13.6	12.2	12.9
1918	600,447	610,100	1,210,547	12.8	10.6	11.6
1919	678,508	652,776	1,331,284	13.0	6.9	9.9
1920	772,891	744,402	1,517,293	13.9	14.0	13.9

The net average increase per cent. over five years, 1916, 1917, 1918, 1919 and 1920, is as follows: European, 14.38; native, 10.76, all cattle, 12.48.

The cattle exported from the Territory rose from 27,735 in 1919 to 37,285 in 1920, or 31.8 per cent. Cattle imported into Southern Rhodesia during 1920 numbered 961, as against 954 in 1919.

An analysis of the composition of European-owned herds is given below:—

ANALYSIS OF COMPOSITION OF EUROPEAN-OWNED HERDS.

	1918.	1919.	1920.
I. Proportion of females to all cattle	60.1 per cent.	60.1 per cent.	59.8 per cent.
II. Proportion of all bulls to total males	26.2 per cent.	26.0 per cent.	29.6 per cent.
III. Proportion of stud bulls to all bulls	12.0 per cent.	12.1 per cent.	10.6 per cent.
IV. Proportion of untrained oxen to all oxen	60.8 per cent.	65.4 per cent.	63.1 per cent.
V. Number of untrained oxen	107,454	130,833	137,780
VI. Number of trained oxen ...	69,170	69,158	80,399
VII. Acres of land cultivated	205,439	215,276	241,236*
VIII. Acres cultivated per trained ox	2.9	3.05	3.00

* Estimated.

The slight decrease in the proportion of females to all cattle—line I.—is due probably to the falling off towards the end of the year of the demand for slaughter cattle in the southern market.

Although the proportion of stud bulls to all bulls—line III.—has slightly diminished, stud bulls increased from 8,513 in 1919 to 9,809 in 1920.

Untrained oxen increased from 130,833 in 1919 to 137,780 in 1920, or 5 per cent.

PURE-BRED CATTLE.

The totals of pure-bred cattle are set forth in the following table:

	1919.	1920.
Africander... ..	1,535	2,770
Shorthorn	1,727	1,595
Red Lincoln (not separately given in 1919)	...	242
Devon	823	947
Hereford	776	914
Friesland	805	804
Aberdeen Angus	408	476
Sussex	262	330
South Devon	164	285
Red Poll	32	53
Ayrshire	70	48
Jersey	4	4
All other	4	...
Total	6,610	8,468

The comparatively large difference between the totals for the two years is due chiefly to an abnormal increase in Africanders of 1,235 head, the figures for which appear to be reliable. It is evident, however, that cattle of this breed entered in the pure-bred columns this year were not so regarded in 1919. It is also evident that the term "pure-bred" is not fully understood by some owners, as in a few instances particulars of native cattle were entered in that column. Africanders of a pure strain are regarded in the light of pure-bred cattle and are tabulated as such, but the term seems to be somewhat loosely applied and should not be used for common native cattle. It would appear as if the forms were not always fully understood and that explanation of our requirements to those who are in doubt would be helpful. This will be willingly furnished whenever asked for.

Shorthorns increased by 110 head or only 6.3 per cent. during 1920. In deference to a wish expressed, the Lincoln Red Shorthorns are this year shown separately.

Devons increased from 823 in 1919 to 947 or 15 per cent. in 1920, while South Devons rose from 164 in 1919 to 285 or 73.7 per cent. in 1920, a remarkable advance.

The Hereford breed appears to be gaining in popularity. They increased by 138 or 17.7 per cent., and in number have passed the Frieslands, which remain stationary.

Substantial increase is recorded in Aberdeen Angus, Sussex and Red Polls. The latter, which is one of the less well known dual purpose breeds, appears to be advancing in popularity though still rare in Rhodesia.

Ayrshires declined in numbers and are but few all told.

Specialisation in particular breeds is growing in favour. Each breed has its supporters. The results are to be seen in the show yards.

It is interesting to notice the preponderance of pure-bred stock in Matabeleland, 5,370 head against 3,098 in Mashonaland, owing to the presence there of long established breeders.

This fact must be reflected in the character of the stock locally, even although the bulls bred are distributed all over the Territory. Insiza district holds pride of place with 1,100 pure-bred cattle owned primarily by a number of prominent stud breeders in the neighbourhood of Shangani; Bulalima-Mangwe comes second in the country with 987, Gwanda third with 947, then only Victoria with 721, followed by Nyamandhlovu 513 and Gwelo with 513 head. The leading maize districts take comparatively low positions in regard to stud cattle.

The total number of tanks in the Territory is 1,639, or upwards of one to every thousand head.

Poultry.—This industry does not appear to be receiving the all-round support it deserves. The increase in numbers in 1920 compared with 1919 was 8,945 or 8.9 per cent. Eggs sold totalled 144,047 dozen, an increase of 7,640 dozen. The increase of birds of all breeds is really greater than appears from the returns, since in the townships for which no figures are available it is known that a very large increase is taking

TABLE III

District.	Animal Products sold, 1920.							Wagons.		
	Eggs. doz.	Cream. lbs.	Milk. lbs.	Butter. lbs.	Cheese. lbs.	Wool. lbs.	Ox.	Mule.	Donkey.	
Wankie	8,401	1,408	136,006	12,911	10,840	...	1	...	1	
Nyamandhlovu	4,847	11,067	25,600	6,276	...	...	35	4	7	
Bulalima-Mangwe	10,856	65,317	31,580	1,977	150	...	56	6	12	
Matobo	4,184	122,157	31,580	8,475	...	...	38	1	20	
Umtali	1,265	16,748	2,580	3,418	...	...	13	4	7	
Bulawayo	12,411	31,574	823,410	3,515	3,180	300	55	32	23	
Sebungwe	...	...	...	...	...	...	...	...	...	
Bubi	3,023	41,493	134,060	8,241	...	...	5	...	...	
Insaiz	7,412	36,095	2,000	6,202	...	...	114	5	11	
Belingwe	1,158	29,200	2,000	562	...	...	59	1	10	
Gwanda	670	6,885	4,000	350	400	...	148	1	10	
Selukwe	1,500	2,501	6,000	2,583	...	...	33	3	6	
Gwelo	16,566	90,719	108,661	21,760	60	5,130	59	18	25	
Guta	...	...	...	...	...	...	175	...	...	
Chibi	386	3,140	400	779	...	...	19	1	...	
Ntanga	...	...	...	...	...	...	21	3	...	
Chilimanzi	4,638	2,151	55,050	2,922	...	...	15	...	...	
Charter	2,787	17,806	22,045	6,882	6	...	12	3	18	
...	5,395	22,660	99,253	4,110	...	...	54	1	2	
Marandellas	...	...	...	...	...	...	60	4	15	
Hartley	5,204	11,868	21,100	9,728	391	130	83	6	6	
Salisbury	7,914	41,955	101,049	11,246	400	...	189	20	16	
Lomegundi	11,667	14,215	820,474	70,911	100	700	181	22	22	
Mazoe	3,846	49,750	39,616	8,274	213	...	135	12	7	
Darwin	5,150	14,464	61,505	7,221	1,500	150	226	22	8	
...	110	...	...	80	...	...	3	...	1	
Mtoko	...	...	...	...	...	...	...	...	...	
Mrewo	1,340	...	...	3,562	200	...	10	1	1	
Makoni	10,470	14,371	27,520	18,583	9,723	200	26	3	3	
Nyanga	1,047	...	...	928	80	3,081	70	2	2	
Umtali	9,189	...	87,065	20,244	...	...	20	1	3	
Melsetter	2,511	200	14,940	2,953	6,214	3,497	72	11	11	
...	...	...	...	...	...	...	27	2	20	
Totals	144,047	618,584	2,655,190	244,761	33,457	14,088	2,125	198	283	

TABLE I.

District.	Total.	Cows and Hotters over 1 year old.	Heifers under 1 year old.	Sind Bulls.	Other Bull Calves.	Trained Oxen.	Other Oxen.	Horses.	Mules.	Donkeys.	Sheep.		Goats.	Pigs.	Poultry.
											Merino.	All other.			
Waskie ...	8,450	3,977	1,116	87	1,090	965	1,255	10	23	44	...	...	175	381	2,044
Nyramandlov ...	13,762	6,391	1,496	135	1,392	2,505	2,505	52	22	244	...	...	329	434	2,515
Buitima-Marye ...	26,691	13,143	3,813	341	3,336	4,113	4,113	82	32	619	77	...	1,447	1,068	5,445
Murao ...	10,244	4,875	1,333	102	1,147	1,046	1,741	64	80	650	80	...	652	469	2,325
Umzingwane ...	6,682	3,122	534	77	552	671	1,676	31	17	246	...	...	1,988	242	1,111
Bulawayo ...	12,875	6,040	1,795	129	1,404	1,565	1,882	263	332	571	110	...	2,788	435	4,263
Schudgwe ...	329	141	32	3	32	96	27	2	...	4	...	...	...	...	...
Bubi ...	30,230	13,634	3,536	310	3,143	4,046	5,511	102	69	495	54	...	1,897	932	225
Isizwa ...	45,212	22,424	5,101	610	5,270	2,229	3,576	132	88	399	731	...	2,498	682	715
Belungwe ...	18,341	8,419	2,281	186	2,001	3,188	3,236	49	57	185	20	...	2,381	281	3,945
Gwarda ...	46,946	25,026	3,576	391	1,130	3,188	15,984	64	54	318	...	...	492	443	1,502
Selkwe ...	2,891	3,988	1,686	159	1,328	1,770	1,930	45	28	23	46	...	369	239	1,480
Gweilo ...	73,489	38,150	10,709	1,186	10,450	7,279	10,735	136	188	769	1,265	...	364	201	1,459
Guth ...	6,870	4,908	1,218	149	1,127	888	1,630	25	2	26	71	...	354	163	1,536
Chibi ...	56,838	28,450	7,374	869	7,439	863	14,031	24	37	5	...	...	10	15	183
Ntanga ...	17,819	9,374	2,474	439	4,395	1,711	1,287	6	6	68	...	...	251	24	11
Vicoria ...	39,279	18,062	4,864	439	3,474	3,898	6,198	162	76	160	...	...	2,008	1,278	719
Chilmanzi ...	32,216	16,693	3,775	350	3,474	1,626	4,198	69	34	83	...	...	1,142	435	5,132
Charter ...	27,209	13,298	4,494	380	2,331	2,792	4,038	283	76	299	263	...	2,103	1,090	3,184
Marandellas ...	28,568	14,373	3,857	365	3,826	2,673	3,474	80	54	171	12	...	791	321	5,201
Hartley ...	62,507	28,231	8,521	825	6,732	6,681	11,517	141	113	423	207	...	2,175	1,053	4,531
Sisibabuy ...	44,217	19,043	5,779	349	4,732	8,205	6,092	107	447	891	98	...	1,758	1,264	9,237
Lomaguani ...	39,391	13,627	3,625	323	3,149	5,177	4,490	57	57	103	24	...	1,214	1,652	8,452
Mazoe ...	41,161	16,210	4,723	451	3,481	11,054	5,242	259	259	209	90	...	1,525	1,018	5,069
Darwin ...	673	288	79	6	67	166	67	6	...	23	...	...	...	...	2,267
Mitoko ...	1,719	657	203	14	191	462	162	2	2	17	...	...	...	...	48
Mrewa ...	4,058	1,485	632	37	415	1,022	567	13	...	75	...	...	...	...	168
Makoni ...	22,996	11,552	3,072	262	2,853	2,602	3,257	130	56	197	...	...	...	...	1,335
Lympu ...	4,602	2,088	3,790	52	544	429	3,731	6	24	66	55	...	722	373	668
Umtali ...	25,635	12,914	3,170	402	6,510	2,968	3,811	125	185	237	694	...	1,106	90	5,945
Meseter ...	20,861	10,610	2,645	308	2,118	1,124	4,056	199	58	751	2,207	...	766	778	6,233
Totals ...	772,891	365,835	96,889	9,809	82,179	80,399	137,780	2,891	2,496	9,116	7,177	...	36,667	19,435	109,394

TABLE II.

[illegible]

place. As evidence of this may be instanced the better supply and more uniform price of eggs during the months when they have hitherto been almost unobtainable.

Animal products are given in tabular form below, the increases and decreases being shown. The decrease in milk, butter and cheese is counterbalanced by an increase in quantity of cream sold, showing a wise tendency to take greater advantage of creameries instead of making butter at home.

Another factor which may have had a detrimental effect on the output of animal products was the abnormal rainfall recorded towards the end of the year in many parts, but more especially in the south-western districts.

ANIMAL PRODUCTS.

		1919.	1920.	Plus per cent.	Minus per cent.
Eggs, dozen	... ..	136,407	144,047	5.6	...
Cream, lbs.	... ..	336,020	618,584	84.0	...
Milk, lbs.	... ..	2,908,392	2,655,190	...	8.7
Butter, lbs.	... ..	294,784	244,761	...	16.2
Cheese, lbs.	... ..	44,076	33,457	...	24.0
Wool, lbs.	... ..	19,658	14,088	...	28.3

The quantity of cream exported to creameries in the Union during 1920 was 5,882 gallons.

The following tabular statements are appended, viz.:—

1. Live stock as at 31st December, 1920.
2. Pure-bred cattle.
3. Animal products sold during 1920.

The Interdependence of Crop Rotation and Mixed Farming.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

From time to time during the last ten years through the pages of this *Journal*, in lectures delivered to farmers' associations, through the press and by other means, the importance of the adoption of crop rotation and mixed farming in order to maintain and increase crop yields has been urged. The change from grain growing to mixed farming is always apt to be adopted but slowly, and the pressing need for rotation of crops has perhaps temporarily been obscured by the high price of grain, and also the good yields which, owing to the last two or three favourable seasons, have been secured. Crop returns on the Salisbury Experiment Station, referred to on page 33 of the *Agricultural Journal* for February, 1921, indicate, however, that land continuously cropped to maize and which in a normal season would show signs of exhaustion, may, in a year of optimum weather conditions, show a temporary and misleading recovery in its apparent fertility. This was the case with the continuous maize plots in the years 1918-19 and 1919-20, when the yield of the sixth and seventh successive crops of maize, always without manure, rose to 9.9 and 11.5 bags an acre respectively, as against an average for the previous six years of 6.18 bags per acre. The increase can be attributed to no other cause than to particularly favourable seasons, and if the same has been the case in other parts of the maize belt there is danger that many maize growers may have been deceived as to the extent to which their soils are becoming impoverished by continuous cropping to maize.

Is the Present System of Cropping Satisfactory?—Force of circumstance, and not climatic conditions, has in the past encouraged continuous maize growing. Maize has been the only essential crop producible on a large scale and meeting with a ready market within and without the Territory. Dairying, pig raising and allied lines of farming which lead to crop rotation have been in their infancy. Gradually these industries are developing, however, and simultaneously many farms are giving eloquent signs of soil exhaustion, due to lack of rotation and of manuring.

That thought is being given to the evils of soil exhaustion is evidenced by correspondence which has appeared in the local press, but from the views expressed it is clear that the accepted meaning of the

term rotation as a palliative is by many inadequately understood. To begin with, the need has been suggested of finding a more profitable crop than maize, and to meet this need certain fibre crops have been suggested. Again, it has been said that very few, if any, *new* profitable crops have been brought to the notice of farmers in this country. At a recent farmers' association meeting the statement was made that the only way to treat lands which had become poor by constant use for maize seemed to be to let them become fallow and plough in either the weeds or some green crop. Yet again a prominent grower has expressed the view that it is sound policy to grow maize continuously as long as maize will pay. Herein, of course, is the whole crux of the matter. The right system of farming is the best paying system, but this does not lie in the direction of continuous grain growing, year after year, either in Rhodesia or anywhere else, except possibly in the case of short-lease tenant farmers. Rhodesian farmers own their farms, or expect to do so, and a system which at first sight may appear profitable requires the light of experience and the passage of time before it becomes apparent whether it really is so or not. This is one aspect of continuous maize cropping. For a few years, in default of a better system, it may have been profitable in respect of actual cash returns, but the evil effects of it are being felt to-day, and with a return to pre-war prices for maize, the necessity for higher acre yields, and thereby reduced costs of production, is imperative.

The late President of the Maize Breeders and Growers' Association publicly gave it as his opinion that four-fifths of Rhodesian maize growers are failing to grow maize at a profit. The cost of the production is largely dependent on the number of bags raised per acre. Heavy yields cannot be expected without either manuring or rotation, and permanent agricultural stability will never be maintained in this country by grain growing alone. At best it can be regarded as a means to an end, and it is useless to disregard the fact that it is bound to lead to ever-decreasing crop yields, with consequent increased cost per bag for production.

Rhodesia is a young agricultural country, and has many difficulties to contend with, but she has one advantage at least, namely, of being able to learn from the experience of other countries which within recent years have also passed through pioneer stages of farming. It is disquietening that even among our older established farmers these conditions of pioneer farming are not passing more rapidly. If so large a proportion of maize growers as has been suggested are failing to make a profit from their crop, then it is high time to consider whether other methods of farming can not with advantage be adopted.

Crops for use in Rotation.—In regard to the suggestion that Rhodesia is lacking in alternative crops or primarily needs the introduction of other more profitable crops, it may first be well to consider what crops can be grown in the Territory. Among what may be termed the proved summer crops there are:—Maize, tobacco, manna, tef grass, oats for hay, Sudan grass, buckwheat, ground nuts, sunflower, velvet beans, cowpeas or kaffir beans, dhal, other varieties of beans, sunn hemp, field peas, pumpkins, cattle melons, mangolds,

potatoes, sweet potatoes, linseed, kaffir corn, rapoko and pearl millet. Generally speaking, given proper cultivation and manuring, all or any of these crops can be grown in any of the settled parts of the country. Nearly every geographical division of the globe has one outstanding grain crop for which it is particularly suited—Rhodesia, maize; Canada, wheat; Southern India, rice; Northern India, wheat; New South Wales and Victoria, wheat; Queensland, maize, and so forth.

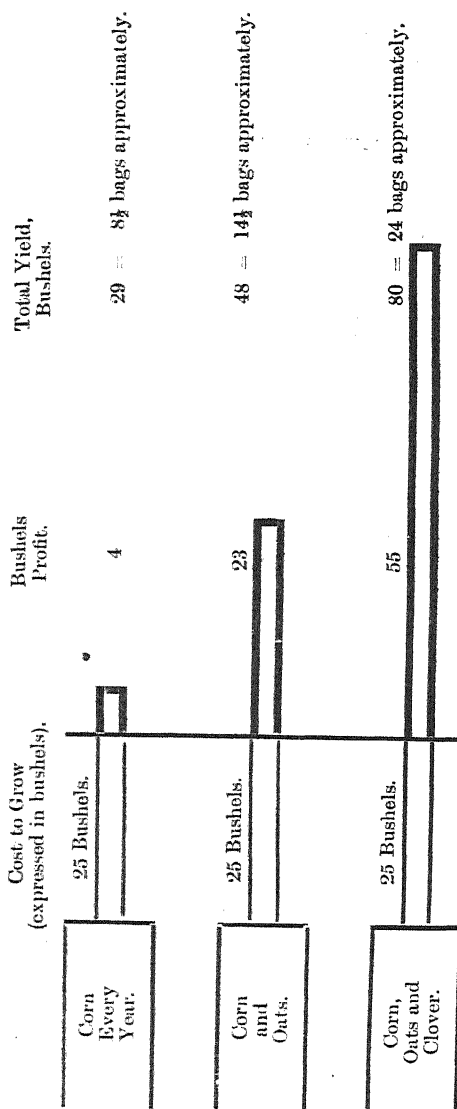
Lessons from Australia.—Taking New South Wales as an example, nearly 75 per cent. of the approximate total of four-and-a-half million acres of arable land is devoted to wheat. Other crops in order of importance are in round numbers:—Hay, 619,000 acres; green forage, 152,000 acres; maize, 146,000 acres; oats, 82,000 acres; orchards and vineyards, 72,000 acres; potatoes, 22,000 acres; together with a further 16,000 acres devoted to barley, beans, rye, onions, root crops, tobacco, millet, pumpkins, melons, hops and sugar cane. If the Commonwealth of Australia as a whole is taken it will be seen that of a rough total of fourteen million acres of arable land, some 68.37 per cent. is devoted to wheat, 18.2 per cent. to hay and green forage, 4.31 per cent. to oats, 2.42 per cent. to maize, and the remaining 6.6 per cent. to other crops, similar to those outlined for New South Wales. The moral of these figures for New South Wales and for the Commonwealth as a whole is surely the relatively large proportion of the land devoted to growing, *not necessarily other saleable crops, in addition to the staple crop, but to stock feed* in the form of hay and green fodders. The same principle holds good in all established farming countries. It is extremely unlikely that any other crop will ever take the place of maize as the staple crop of Rhodesia, and until this fact is widely recognised, and mixed farming with maize as the chief crop is adopted, agriculture in the Territory will remain on a precarious footing.

The One-Crop Farmer.—In general practice the one-crop farmer, if he remains so sufficiently long, invariably ends a poor man; he is continually dissipating his capital (the inherent fertility of the land), and there is but one end to this road. One-crop farming has largely been the pioneer farming of America, Canada and Australia, but these great countries have realised that the basis of agriculture is mixed farming, and thus each year an increase in the proportion of land devoted to growing stock feed as against directly saleable products is apparent.

Referring again to the Year Book of the Commonwealth of Australia, 1918-19, in proof of this contention, it may be seen that in the eight years between 1905-06 and 1913-14 the acreage of land in all Australia devoted to hay crops was more than doubled, and that this level has since been maintained, in spite of the world's demand for wheat during the war. Similarly with green forage, the acreage shown has more than doubled during the period 1905-06, 1915-16. The lines on which Australian farming is developing is obviously therefore not the introduction of new crops to supersede the one crop outstandingly suited to Australian conditions, but rather the greater production of fodder and grain crops for conversion into meat and milk.

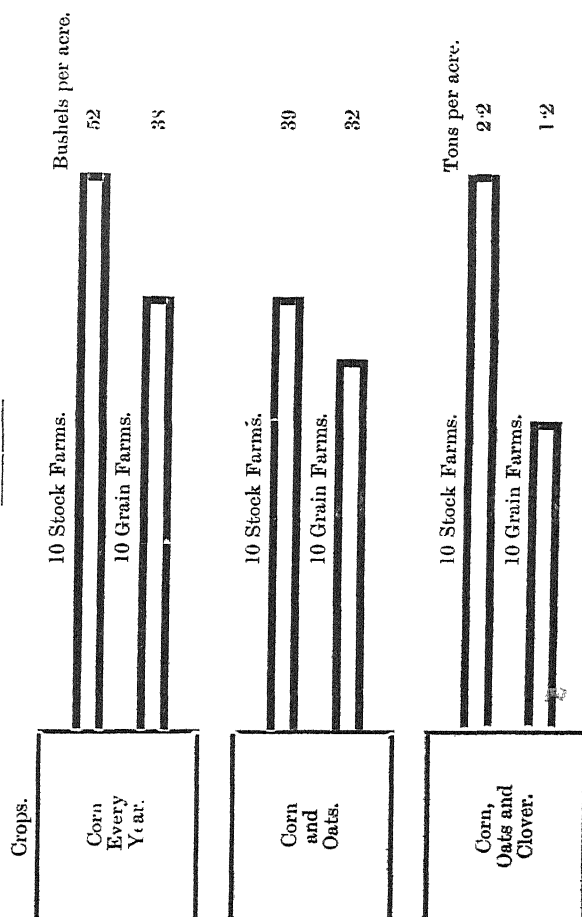
GRAIN FARMING REDUCES PROFITS.

20 Years' Experiments, Illinois, 1888-1907.

*From Illinois Bulletin No. 125.*

STOCK FARMING MOST PROFITABLE.

5 Years' Average.—20 Iowa Farms.—9 Counties.

*From the Iowa Beef Producers' Association.*

Rotations in Great Britain.—At this point, although conditions are less comparable, a brief consideration of the application of rotation as practised in Great Britain may be useful. The oldest scientific British rotation, and the one upon which nearly all other modified rotations are based, is the Norfolk four-course, which consists of (1) clover and grass seeds, (2) wheat, (3) turnips or other roots, (4) barley. After the aftermath of clover has been fed off, the land is dunged, ploughed and sown to wheat. After the wheat crop has been taken off, half may be sown to rye and vetches for grazing and half may be manured by folding and feeding sheep upon it at night. Roots follow, directly manured or not, as the case may be, and in any case these roots are mainly fed on the land. Barley follows the root crop—half the barley being probably undersown with clover, which again will be fed off after the barley is harvested. On the other half, after the barley is reaped a catch crop of trefoil or rye will be sown also for feeding off, after which yet a further catch crop of mustard is often sown and ploughed under. Another instance is the East Lothian six-course, which consists of (1) turnips or swedes fed off, (2) barley, (3) grass seeds, clover and rye, largely fed off, (4) oats, (5) potatoes or beans, (6) wheat. This is an example of a six-year rotation, manure being directly applied to the root and potato crops and indirectly to the barley and oats through the feeding off on the land of the preceding crops.

The Utopian Rotation.—All good husbandry, no matter in what part of the world it may be practised, is based on somewhat similar principles, and this conversion of a reasonable proportion of the vegetable products of the farm into animal products is the very essence of rotation. The Utopian rotation, however, which some farmers would appear to look for is one wherein the grain crop alternates with some other crop, both being directly saleable off the farm, and the two combined by some miraculous dispensation maintaining indefinitely the fertility of the soil. Such a rotation has not yet been found, and is never likely to be found. The only practical method by which soil fertility can be economically maintained is by adopting mixed farming, which insures the feeding on the farm of a proportion of the crops raised, as against the selling off of such crops.

Definition of a Rotation.—An excellent definition of the meaning of a rotation of crops, and one taken from Morton's 'Cyclopedia of Agriculture, published in 1853, is the following:—"An arrangement of a certain succession of crops, by which each shall follow in a rotation as shall best economise the resources of the farm. In other words, that succession of crops which is best suited, in a given locality, to draw from the soil the largest nett return, while the capabilities of the soil are at the same time maintained and increased."

Professor Patrick Wright, in his Standard Cyclopedia of Modern Agriculture, states that the oldest known rotation was grain and bare fallow, but even the Romans prior to the conquest of Britain had a three-course rotation consisting of bare fallow, beans and wheat. This writer's definition of a standard rotation is that "it is the most economical and profitable method of cropping. It reduces labour costs, gives healthier and more productive crops, economises the fertility of the soil and retards its exhaustion."

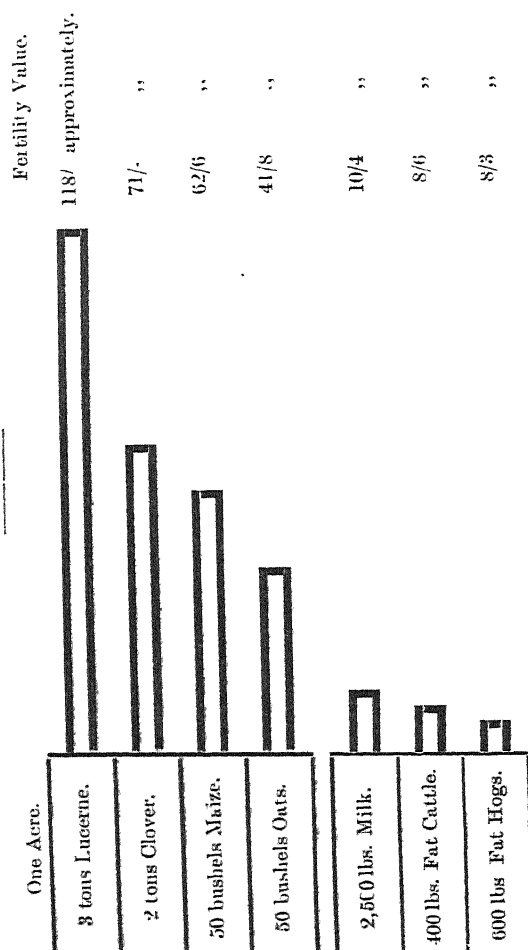
Bailey, in his *Cyclopedia of American Agriculture*, published in 1909, tells us that "the infliction on soils of continuous cropping with one and the same plant (whether wheat, maize or cotton) resulted long ago in a diminution of production, of half to three-quarters or even one-quarter, of the crops originally obtained in the middle west and north-west. The first soil ingredient to be diminished to a serious extent in pioneer farming is humus. Loss of humus occurs through cultivation, whereby unless green manuring or rotation is practised, the natural process of humus formation is done away with, while the exposure of the surface soil to air and sun-heat causes the humus to be almost literally burnt out of the soil. . . . This results not only in a compacting of the surface soil rendering good tilth difficult [and good stands—H. G. M.], but at the same time causes a very serious loss of nitrogen of which soil-humus is the repository."

Increased Yields from the use of Farmyard Manures.—Thus if the history of older agricultural countries is studied, it is seen that as virgin soil fertility has become exhausted, manuring has had to be practised. This in all countries has led to rotation and the consumption on the farm of a considerable proportion of the rotation crops grown, and by this means the production of greater quantities of farmyard manure.

The application of farmyard manure to the land supplies the three chief essentials of plant food—nitrogen, phosphoric acid and potash—and simultaneously adds organic matter or humus. If the marked benefit to crop yields in Rhodesia of dressings of kraal manure voided by veld fed animals, sleeping in open unlittered kraals, is compared with the results obtained in Great Britain from much heavier applications of farmyard manure voided by animals highly fed, often in covered yards and generally well littered down, one cannot but be astonished. How much greater would be the increased yields if this Rhodesian manure was from animals liberally bedded with our superabundant veld hay and fed on an adequate ration of legumes and oil seeds, both of which can so easily be grown?

FEED WHAT YOU RAISE.

Fertility Marketed in Farm Produce.



From Mo. Cir. 371.

NOTE.—In this table the value of a dollar has been taken at 4/2.

Green Manuring and Summer Fallows.—As has been seen, the maintenance of an adequate supply of organic matter or humus in the soil is of primary importance. Without this, applications of artificial fertilisers will seldom be profitable. As well as by applying farmyard manure, organic matter, and to a varying extent nitrogen, can be returned to the land by green manuring or ploughing under green crops.

Green crops, *other than legumes*, return to the soil, apart from organic matter, only that plant food which they have already taken from it. Green manuring, therefore, with non-leguminous crops is of benefit only in direct proportion to the bulk of green fodder turned under. Nodule-bearing legumes, however, have the power of absorbing nitrogen from the air, and it is generally estimated that of the total amount of nitrogen contained in the whole of a leguminous crop, roots.

included, one-third has been drawn from the soil and two-thirds from the air. When legumes are ploughed in, therefore, the soil benefits both by reason of the organic matter and by this added and otherwise unavailable nitrogen. The action of decaying organic matter to some extent assists in the liberation of other plant foods, but this applies equally to legumes or non-legumes. Most legumes, however, are tap rooted, and when these are ploughed in, supplies of phosphoric acid and potash gathered from the sub-soil, and inaccessible to non-tap rooted plants, are put back into the surface soil and rendered available to surface feeding crops.

C. Harlan, in his work on "Farming with Green Manures," states that one ton of average farmyard manure, piled in the open and well rotted, contains about ten pounds weight of nitrogen, seven pounds phosphoric acid, five pounds potash and 1,500 lbs. of water. The quality of any farmyard manure is naturally governed by the diet upon which the animals have been fed, and the higher this diet the better the manure. Harlan contrasts these figures with the following amounts of plant food contained in various crops suitable for green manuring:—

	Nitrogen.	Phosph. Acid.	Potash.	Water approx.
1 ton green maize	6 lbs.	2½ lbs.	8 lbs.	1600 lbs.
1 ton Hungarian millet	7 lbs.	2½ lbs.	9 lbs.	1360 lbs.
1 ton buckwheat	8 lbs.	2 lbs.	6 lbs.	1675 lbs.
1 ton rye	9 lbs.	5 lbs.	14 lbs.	1400 lbs.
1 ton sweet clover	12 lbs.	5 lbs.	13 lbs.	1600 lbs.
1 ton Soy beans	12 lbs.	3 lbs.	11 lbs.	1500 lbs.
1 ton cowpeas	12 lbs.	3 lbs.	9 lbs.	1700 lbs.
1 ton vetch	13 lbs.	3 lbs.	10 lbs.	1650 lbs.

When it is remembered that the green yield of any of these crops will normally average from 4 to 7 or even more tons per acre, the importance and value of green manuring, especially with legumes, as an alternative method of maintaining fertility at once becomes apparent.

An objection to green manuring in Rhodesia is the fact that except on irrigable land it means an entire year without any directly profitable crop, either for sale or feed, occupying the land. For this reason it is generally more economical to grow leguminous rotation crops and feed them, in conjunction with other crops, into live stock, thus obtaining larger and better supplies of manure. On the other hand, green manuring should always be regarded as a means whereby land which cannot be treated adequately with farmyard manure can yet be maintained in fertility. For this reason it is a system which is specially to be recommended in Rhodesia, where the acreages under crop are so large and the amount of farmyard manure available so small.

Summer fallowing, or permitting the land to grow a crop of weeds which it is later intended to turn under, is better in general practice avoided. Although this system, if carried out, will undoubtedly assist the rejuvenation of the land and add considerable supplies of organic matter, there is always the danger that it may be impossible to plough

down the weeds at the right stage. If left too long, through pressure of other work, the plants seed, and dirty lands for the next two or three years will result.

The Practical Application of Mixed Farming.—As applied to Rhodesia, crop rotation and mixed farming will not entail either a decrease in the total production of maize nor for many years the bulk of the grain grown on a maize belt farm being consumed on the farm. Experience in many parts of the world has shown that the adoption of mixed farming, as against grain growing alone, tends not to reduce the total grain production, but rather to increase it by reason of the heavier grain yields per acre. It does mean, however, that a reasonable percentage of the land each year under crop will be devoted to leguminous soil-improving and other crops, and these in almost all cases can only be utilised to best advantage if fed into live stock. Not only will this ensure higher quality manure being made, but also more manure, for the class of stock which will pay for feeding will also pay for being comfortably littered down with bedding, instead of being left to stand for months of the year in flooded kraals or yards.

Mixed farming probably cannot be practised to a *maximum* profit until a sufficiently high grade of live stock is kept on the farm to take full advantage of good quality fodder fed into it. What this class of live stock is, each farmer will decide for himself, *but rotation should not be delayed until the ideal grade of live stock has been arrived at.* It is true that inferior grades either of beef or milk cattle will not pay for the feeding as well as higher grades, but these latter have generally been worked up to gradually. Meanwhile the growing of the rotation crops and their conversion into manure, coupled with green manuring, will increase the grain yields from the land devoted to grain crops, and will maintain and permanently build up the soil fertility. Similarly, through the feed put into them, the quality of the live stock will improve more rapidly.

Conclusions.—Economical crop rotation entails mixed farming. A combination of the two is the foundation of permanent agriculture. By their adoption—

- The gross output of maize will be increased.
- Costs per bag of production will be reduced.
- Soil fertility will be maintained.
- Weeds, insect pests and plant diseases will be better controlled.
- Soil erosion will be lessened.
- Farm labour throughout the year will be better and more economically distributed.
- Risks of crop failure will be minimised.
- Capital value invested in arable land will appreciate the more, as soil fertility ceases to be exhausted.
- The eggs will not be all in one basket.
- The farm will be a farm.

[*Note.*—The diagrams used to illustrate this article are taken from the lecture charts prepared by the International Harvester Company of New Jersey, U.S.A.]

The Shows.

Annual agricultural shows have taken place at Victoria, Bulawayo, Enkeldoorn, Umtali, Rusape and Sinoia, each fulfilling its purpose of demonstrating the possibilities of the district represented and helping along the development of the pastoral and agricultural industries of the country. The district shows meet a local demand which the larger shows cannot fulfil, and afford those who have no opportunity of attending the principal shows some indication of the progress which is being made in their particular district. They also serve the purpose of bringing together scattered communities in a way which is not possible otherwise, and provide an opportunity for an exchange of views on matters in which all are deeply interested. The quality of the exhibits at these district shows was as a rule high, and it is evident that lessons have been learnt from the past, but, generally speaking, the entries in various classes this year were fewer than they should have been. The paucity of entries would appear to be due to lack of confidence and perhaps public spirit, rather than to lack of material of the requisite quality for exhibition. This is to be deplored, and we can only hope that the example of others will stimulate those very desirable qualities of local patriotism and emulation. It must be realised that success can only be achieved by painstaking organisation and by the whole-hearted co-operation of all farmers in the district. We hope next year to see a larger number of exhibitors and of exhibits.

Cattle.—Veterinary regulations made it possible for cattle to be exhibited at all the shows, and viewing the matter generally the class of beast shown demonstrated forcibly the improvement taking place in the cattle of the country. Especially was this improvement marked at Victoria, where a particularly good class of stock was on view. The Devons exhibited by Mr. J. Struthers were a feature of this show, and to one of his animals went the championship for the best bull in the yard. A very nice Shorthorn bull shown by Mr. Jacobson of Gwelo ran the winner very close. Mr. Radcliffe put on some excellent Shorthorn dairy stock, and the award for the best cow on the show was secured by a Lincoln Red, the property of Mrs. Cary. Other exhibitors showing good cattle were Mr. W. B. Richards and Mr. Peck, the latter of whom exhibited some useful Frieslands.

The Bulawayo show has been written down as an unqualified success by the daily press, and with this description we concur so far as the cattle exhibits were concerned. The Bulawayo show already ranks as one of the foremost cattle shows of South Africa, and the energetic committee are to be congratulated upon the results of their efforts. The Hereford classes, augmented by a string of 19 pedigree bulls sent up by Sir Abe Bailey, were the feature of the show, and it is extremely

creditable to Mr. C. Jobling, in the face of strong competition, to have secured the show championship and the Thousand Guinea Trophy with "Devonby Damocles," a bull of his own breeding, and both of whose parents he also bred himself. Mr. Jobling's success will be acclaimed by all cattle men in this country, and affords further proof of the suitability of the Rhodesian veld for raising cattle of the first quality.

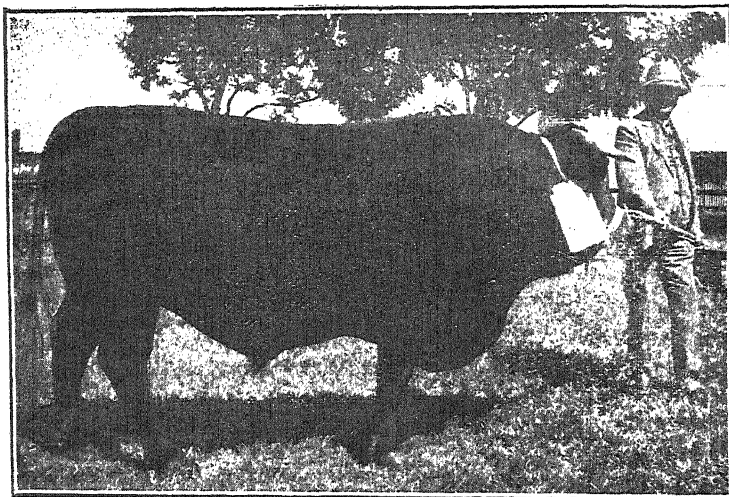
"Devonby Damocles" is a very perfect specimen, and took a high place in the shows last year also. It is noteworthy that he is not for sale, but remains as head of the herd in which he was bred, a token of his owner's opinion of him as a sire as well as a winner and a promise for the future of the Devonby stud.

The runner up, a Shorthorn remarkable alike for substance and style, is the property of Mr. Morum, of Queenstown, Cape Province, and has been a notable winner at Union shows recently. He had not fully recovered from his journey, and so perhaps did not do himself entire justice, yet the judges, all of whom but one were from the Union, had no hesitation in unanimously giving the blue ribbon to Mr. Jobling's Rhodesian bull.

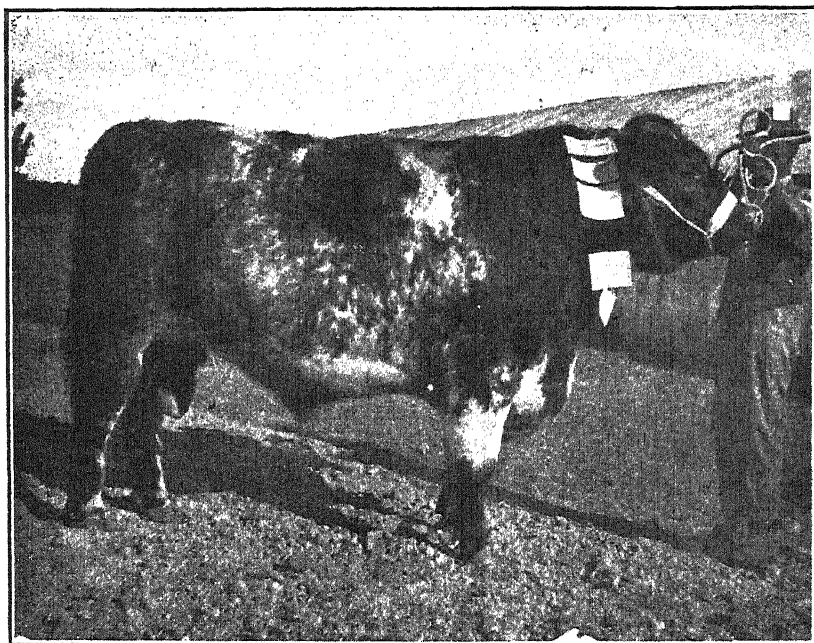
Large classes and keen competition were the features of this the premier cattle show of Rhodesia, and many classes would have done credit to their breeds at Home; indeed, not a few imported animals of great merit adorned the stalls, particularly amongst the Aberdeen Angus, Shorthorns and Devons. Bulawayo becomes more and more the bull buyers' show, and in the sale ring opinions are backed by bids. Prices ruled lower than in past years, but that was not due to lack of quality, but to lack of funds, owners having to bow to the inevitable, though within certain reasonable limits the demand was keen. Above all else, Bulawayo is a bull show, and in that direction it has achieved outstanding success.

Enkeldoorn is to be congratulated on the great success of the first agricultural show held in that district. As an exhibition of cattle, produce and domestic industries the show compared favourably with other district shows in the country, and great credit is due to those who organised and worked for this result. The show afforded a good indication of the advantages and possibilities of this portion of the country, which are greater than many suppose, and are not yet sufficiently known to the public at large. The new settler can well be recommended when selecting a farm to consider Enkeldoorn.

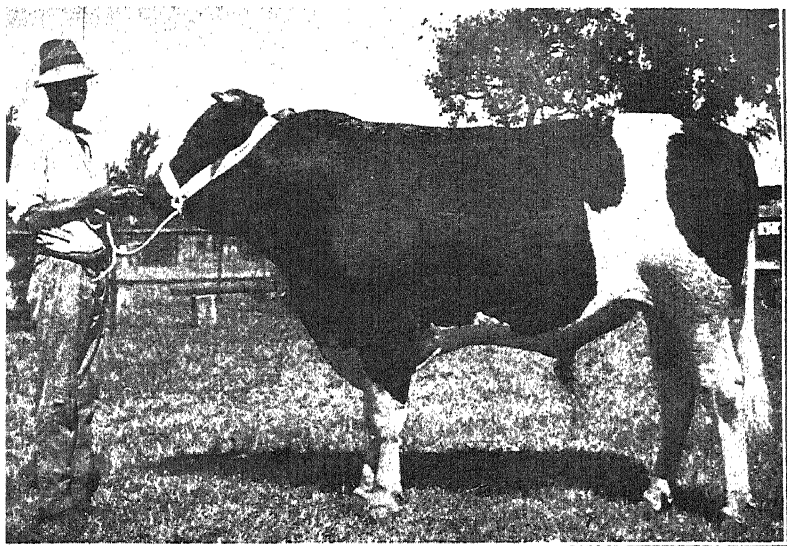
There were no fewer than 180 entries of cattle, the principal exhibitor and winner being Mr. P. O. Brocklehurst. The breeds best represented were the Afrikander and Hereford, including grade stock produced from them, which is always the crucial test, and one more often seen at district shows than at Bulawayo and Salisbury, as these larger shows partake more of the nature of exhibitions of stud stock than of the products of pure breeds of the cattle of the country. The good type of matured grade cows exhibited proved the excellence of the veld for the proper development of stock, and this was further borne out by the excellent display of spans of oxen of similar breeding. A somewhat unique element was a heifer of the Galloway breed,



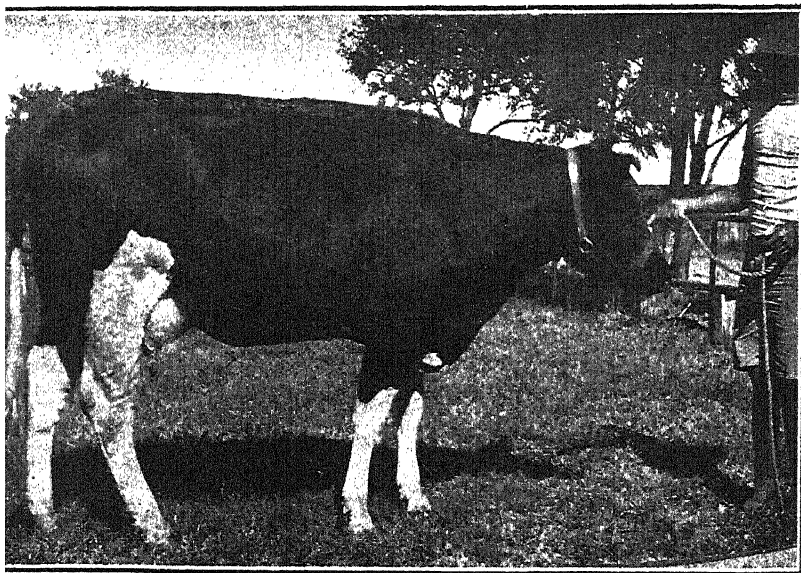
"Pound Leader," champion Devon bull, Bulawayo Show, 1921, and best North Devon animal on show. Owner Mr. A. Coles.



"Polmaise Trophy," runner-up for 1,000 guinea trophy, Bulawayo Show, 1921, and winner of challenge cup presented by Shorthorn Society of S.A. for best animal in Shorthorn or Red Lincoln Shorthorn classes. Owner Mr. Victor Morum.



"Colonies Plaats Pel Konrad," champion Friesland bull, Bulawayo Show, 1921. Owner Mr. J. Radford.



"De Grendel Jessie," champion Friesland cow, Bulawayo Show, 1921. Owner Mr. C. R. English.

which surpassed females of other breeds shown against her, whilst an Afrikaner took the premier honours amongst bulls, the owner, Mr. Homman, being a conspicuous winner with this breed.

The gratifying results of this first show at Enkeldoorn are due to the united efforts and enthusiasm of everyone in the district. The entrance fees amounted to no less than £550, while many generous donations were made, including £25 by the Dutch Reformed Church, together with material for the produce hall. Special mention should be made of the work of Mr. G. W. Cumming; the Cattle Inspector, the Rev. Mr. Liebenberg and Mr. McLeod (the secretary), assisted ably by Messrs. P. O. Brocklehurst, Tom Berry, Coetzee, P. L. Ferreira, Cook, Hoffman and many others.

Although perhaps hardly within the scope of an agricultural criticism, it is perhaps permissible to mention that subsequent to the show a memorial celebration was held of the 25th anniversary of the establishment of the Dutch Reformed Church in Enkeldoorn, an event which marked the successful settlement of that region. The graves of the early pioneers were visited and wreaths deposited, whilst at that of Commandant Ferreira, the leader of the voortrekkers who first came up, a memorial service of a very impressive character was held, thus demonstrating that the Enkeldoorn district had besides a pride in its modern prosperity a proper regard for its past history.

The cattle at Umtali and Rusape were as regards quality of a very high order, and a proof of the remarkable improvement which is known to be going on in these eastern districts, but the small numbers in each class were disappointing alike to judges, competitors and the public. This was alike noticeable in the breeding and fat classes and in the milking tests, and is not to be improved by the mere offer of cups or valuable prizes, for Rusape, without such attractions, did nearly as well as Umtali with a generous prize list. As showing that the prize winners desire and welcome competition, it may be mentioned that one exhibitor who has for many years been pre-eminent at Umtali was so pleased at being beaten in one particular class by a recent comer that he gave him a heifer in celebration of his success.

Mr. Strickland, of Penhalonga, showed some excellent Devons, both North and South, and with his imported Devon bull gained the championship. This massive and stylish animal is an extremely fine specimen of the Devon breed. Mr. Harnden, of Rusape, is to be commended for bringing his valuable Shorthorn cattle to the show, and his example might well be followed by farmers in the Umtali district. He gained his reward by sweeping the board. This success was repeated at Rusape, where he won most of the Shorthorn classes and also the open championship for the best bull. Other exhibitors at Rusape were Mr. R. le S. Fischer, of Headlands; Rhodesia Lands, Ltd.; and Mr. N. Tapson.

The Sinoia show was an unqualified success, a result achieved by the helpful community spirit which animates the farmers of the Lomagundi district. At present crops receive more attention than do cattle, but there were some fine specimens of the following breeds on view:—Frieslands, Shorthorns, Africanders and Polled Angus, exhibited by Mr. Struthers, Dr. Hewetson, Messrs. Higgs and Kneiser

respectively. These gentlemen practically won every award in their cattle classes. Taken as a whole, Mr. Higgs' Africanders were the striking feature of the show. The champion animal on the show, however, was Mr. Kneiser's Polled Angus cow. It is worthy of note that three of Mr. James Struthers' Frieslands were of the second generation and two of the third, Rhodesian-bred by himself.

Produce.—In the produce section at Victoria it is gratifying to be able to state that very considerable improvement was noticeable in the quality of exhibits. This was particularly the case in the maize classes, and to a lesser extent in the wheat and fodder classes. In view of great possibilities of this district for general agriculture, much improvement can yet be accomplished before the show adequately reflects the capabilities of Victoria for crops of all kinds. In the maize classes Mr. Rademeyer's 100 cobs of Salisbury White maize marked a great advance on anything seen previously at this show, and the exhibit will worthily uphold the reputation of the district at the central show at Salisbury. The fact that good seed produces good crops cannot fail to be evident, and the results of the seed selection work done by Mr. Rademeyer, Mr. Hutchons and Mr. Norman Richards in this respect will be reflected both on farm and show bench.

The wheat exhibits also call for attention, partly on account of the excellence of the exhibits by Mr. Radcliffe and Mrs. Carey, and also for the reason that in this important article of farm produce the number of exhibits hardly reflects what is actually being done in this district.

Mr. R. W. Evans is to be congratulated on his winning exhibit of general farm produce for stock feed. This collection represented an attempt to present a complete and satisfactory ration for the maintenance of cattle—a point that is frequently overlooked in exhibiting a collection of food products at shows.

The crop and produce exhibits at Bulawayo call for mention for two reasons: first, owing to the high standard of excellence attained in the produce shown by three or four exhibitors, and, secondly, by reason of the rather poor competition in and indifferent quality of the rest of the produce.

Mr. I. Brebner, of Bulawayo, although not an exhibitor, has for years grown maize crops equal to the average of those produced in the Mazoe Valley. Mr. S. J. Townsend, of Copleston Farm, near Bulawayo, exhibited this year in all classes of White Flat maize. In every instance these ears were of fine quality, showed plenty of constitution, and were evidently the produce of carefully selected seed. While Mr. Townsend swept the board in the maize classes, he was followed closely by Mr. H. H. Williams, of Inyati, who was usually the runner up and generally with almost equally good exhibits. Apart from these two exhibitors, who clearly demonstrated that good maize can be grown in Matabeleland, the remainder of the grain called for no special comment.

The Ingutsheni Asylum staged a magnificent collection of general farm produce which did not contain a single indifferent specimen of its type, and also exhibited Mammoth Long Red mangels, equal, if not

superior in size, to anything previously seen in the Territory. Among some five or six entries, a particularly nice sack of King of the Early potatoes was also staged, and came in for very favourable notice.

Entries of stock feed were poor. There were 3 to 4 entries of ground nuts, but of these only the winning exhibit was of high quality. No linseed was shown, no velvet beans, and only one sack of cowpeas. In the cultivated and natural hay grass classes there was only one entry of each, and these of indifferent quality.

An agricultural show is intended to be an education, and also an advertisement for the district it serves. The primary interest at Bulawayo is of course in the cattle sections, but these should not be allowed to entirely overshadow the produce. If Matabeleland is to build up a lasting pastoral and agricultural prosperity, very much more attention must be devoted to the production of stock feeds, and the ability to grow these should be demonstrated at the show. Matabeleland compares quite favourably as regards climate with many countries where mixed farming is the general practice, and if crop raising was taken more seriously, and if better farming methods were generally applied, the produce exhibits at Bulawayo might compare favourably with those on many of the other Rhodesian shows.

A poor produce display impresses visitors to the show with the view that the country is incapable of producing good crops, and is purely a pastoral area. Many new settlers with limited capital form this impression of Matabeleland, and as a result the number settling in Matabeleland as compared with Mashonaland is few. This is a misapprehension which the Bulawayo Agricultural Society and the farmers of Matabeleland in general might well endeavour to remove.

For a first show the exhibits of produce at Enkeldoorn deserve the highest credit, both for their excellence in the case of the leading features and for the large number of entries in certain of the classes. At no other show in recent years has such a fine display of wheat been staged, nor has the quality been so high. It is hoped that it will be found possible to forward the prize-winning exhibits to the central show at Salisbury, where they should worthily advertise the activities of this insufficiently appreciated district. In the general farm produce, lack of experience prevented the exhibits from being staged to their full advantage, but if this first show is a criterion of what may be done in the future, the Enkeldoorn show is destined to take a leading place in the Territory in respect of some of the most important branches of agricultural activity.

The produce sections are one of the strongest features of the exhibits at the Umtali show. The general fertility of the district and its varied climates enable the farmers to display a greater variety of produce than is usual in any single district. The maize in particular for many years has been of high quality, partly for the reasons given above and partly because the district is fortunate in possessing growers who have consistently given attention to the breeding of maize and the selection of seed. The result of these efforts is becoming more apparent each season in the raising of the general standard of excellence of this crop, and the newer settlers are fortunate in being able

to start at a considerably higher level of quality than was possible some years ago. Great praise is due to Mr. J. D. Maclean in Rhodesia and Macdonald Bros. in Portuguese East Africa, who have for years taken premier honours in the maize classes at this show, and whose seed is of such a high standard that growers would be well advised to avail themselves of it. In the general produce and stock feed classes, attention is well merited in the case of the different varieties of meal exhibited by Mr. Strickland. There is no doubt but that most cattle feeds in the form of grain are best fed as meal; and the comprehensive series of ground meals by this exhibitor served as an object lesson in the important art of feeding. There is much scope for expansion in these classes, however, and the new settlers should set themselves to challenge the supremacy that has been enjoyed so long by the old established exhibitors.

The Makoni district has long been known as a wheat-producing centre. It would therefore be expected that ample exhibits of the leading product would be presented. The actual exhibits, however, were few in number, and although the quality was good, it could fairly be expected that this would be one of the leading features of the produce section. The maize sections show marked improvement both in care of selection and quality of seed; but when compared with the Umtali show, it is obvious that advantage has not been taken of the improved seed available. The use of the best seed will not only result in improved crops as far as quantity is concerned, but also in the number of cobs of good quality that can be selected for exhibition. The potato exhibits stand out as being excellent both in number and quality, and there is no reason why in this respect, and in cereals such as wheat, oats and barley, the Makoni district should not provide features in which it would be pre-eminent in this Territory.

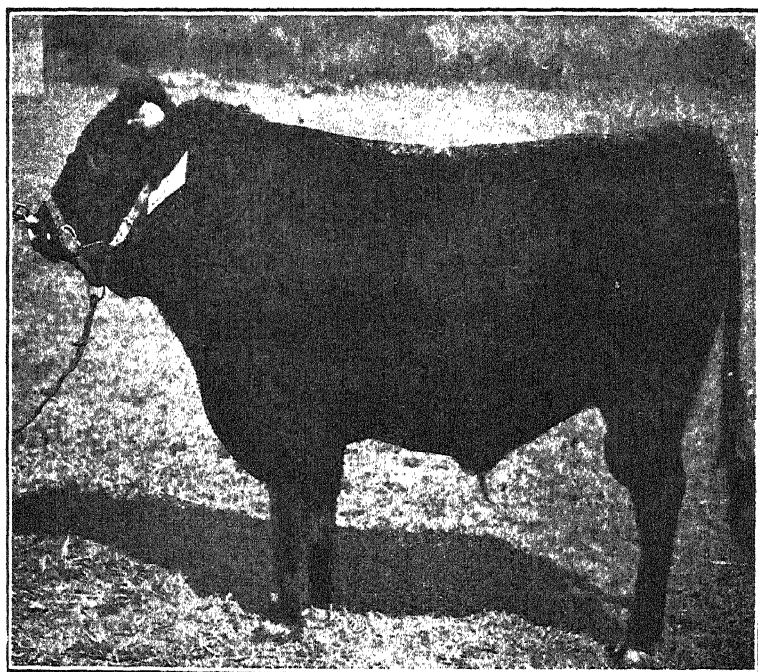
The maize exhibits at Sinoia were an outstanding feature of the show. Entries in all the classes were numerous, and the quality of the grain reached a very high standard indeed. A number of the winning exhibitors will be seen at the Salisbury show.

Poultry.—At all these shows alike a marked advance—greater apparently than in any other direction—has been made in the poultry sections, particularly in the way of utility exhibits. The practical effect of this is a reduction in the imports of eggs, which must eventually give way to a balance of export over import trade and a lowering of the price of poultry and eggs to local consumers.

Dairy Produce.—The quality of the cheese exhibits at all the shows showed a distinct improvement on that of previous years, but the entries as a rule were few. It is to be hoped that those farmers whose farms lie remote from the railway will realise more the advantage to be derived from turning their surplus milk into cheese. The Bulawayo show had on exhibition some fine quality cheeses, and the competition, especially in the Cheddar classes, for the first three places was extremely keen. Mr. Goodrich gained first prize with a cheese of excellent quality and flavour, whilst the other two prizes went to Harley's Cheese Factory, Beatrice. The display of cheese at Umtali was disappointing, and it is to be hoped that next year cheese makers



Judging for championship, Umtali Show, 1921.



Mr. A. Strickland's champion Devon bull, Umtali Show, 1921.

in the Odzi district will rise to the occasion. Mrs. R. C. MacLagan, of Rusape, took first prize at Umtali and Rusape for a really excellent sweet-milk cheese of mild flavour and good texture and colour.

The butter at the shows was generally of poor quality, and not in proportion to the importance of the dairy industry. Great attention must be paid to the preparation of the cream for butter making, and to the working of the butter on the worker. Many butters of excellent flavour failed to reach prize-winning standard through lack of care in working, in finish and in make-up. A useful innovation was introduced at Bulawayo in the provision of classes for creamery butter. It is to be hoped that in future creameries both in Rhodesia and in the Union will exhibit in a greater degree at our principal shows, for the future of the dairying industry lies in the making of good butter for export. Once again we would emphasise the fact that too much care cannot be exercised in the preparation of cream for creamery purposes, and unless farmers realise this there is not much hope of establishing an export trade.

General.—A novel and peculiarly interesting exhibit was made at Rusape by the Rev. Mr. and Mrs. Lloyd, of St. Faith's Mission, in the form of pottery pictures, and an exhibition of clothing and mats woven, spun and dyed at the mission, from local wool and vegetable fibres with colours of much beauty, blue, violet, amber, fawn, dun, grey and red in mellow tints, drawn from roots, flowers, lichens and bark found in the veld. The natives are being taught to prepare and spin the thread, to colour it and weave it into cloth, replacing the inadequate skins or the expensive and inferior limbo procured from the kaffir truck shop. Should more than enough for their own wants be prepared, there can be no question but that for coats and caps these useful and attractive fabrics will find a ready sale to Europeans, and a native industry in every sense of that phrase become established; at least the excellent beginning made gives grounds to hope for this.

Specimens of native timber of several varieties sent by Messrs. Cripps, attracted attention at Umtali, where also planks and furniture were shown from Mrs. P. C. Rutherford's farm Ravenswood, made from M'Sorsgwe (*macaranga mellifera*), a soft, clean, straight timber, readily worked to a smooth surface, showing pleasant warm tints and delightful graining. It is of interest to learn that an up-to-date saw-mill is now in course of being erected at Umtali. This will utilise to advantage the native timbers of the locality and from adjacent Portuguese territory, also probably the exotic gums, cedars and pines that are being actively planted on the surrounding mountains as the outcome of experimental plantations established during the past twenty years, and now showing their merits and great commercial possibilities.

Household produce, particularly in the way of various kinds of preserves, were as usual conspicuous at Umtali, Mesdames Meikle, Strickland and Eickhoff being the principal exhibitors.

We noticed at Umtali and elsewhere a very ingenious water lifting device, consisting of a chain resting within a helical wire coil and running over two pulleys, one under the water and the other at ground

level, actuated by a handle which causes the chain to revolve and rising carry with it an adhering column of water, which is discharged into a tank at any desired height. The surprising spectacle of water being lifted without a pipe attracted much notice, whilst the absence of any valves, or indeed of a pump at all, is a very remarkable feature deserving the attention of those who know the troubles attendant upon ordinary pumping arrangements. This appliance is known as the Helice chain pump, and is obtainable from Messrs. A. F. Philip & Co., Salisbury and Bulawayo.

The Anglo-African Trading Co., of Salisbury, gave at Umtali and Rusape a demonstration of the Koodoo gang plough in its latest form showing, besides the undoubted merits of the implement, the advantage of actual ocular proof of work done and of the implement in motion instead of merely on view on the stand. Messrs. A. F. Philip & Co. also exhibited the Bulldog gang plough, which has given great satisfaction in turning in rank growth of weeds or green manuring crops, as well as doing excellent ordinary ploughing.

Ticks Infesting Domestic Animals in Southern Rhodesia.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

The following article aims at placing in the hands of stockmen, and others connected with the cattle industry, a popular guide to the ticks which infest stock and domestic animals generally in this Territory, together with an account of their habits, life histories, relation to animal diseases and measures employed for their control. It is felt that a handy pamphlet of this nature is likely to prove useful for purposes of reference in view of prevailing legislation and the great influences that these parasites exercise on the stock industry throughout the sub-continent.

Ticks are very clearly divided into two families. There are a number of points by means of which the members of either family may be distinguished, but for our purposes it is sufficient to note that in the family (*Ixodidae*) to which the common cattle ticks belong there is a hard shield on the back of the tick, which in the male covers practically the whole of the back and in the female a smaller area close behind the head (see illustrations of male and female ticks on Plate I.). In the other family (*Argasidae*), of which the Spinose Ear Tick, the Tampan and the Fowl Tick are representatives (see Plate II.), this hard shield is altogether lacking. Also in the *Argasidae*, except in the larval stages, the mouth-parts are invisible when the tick is viewed from above, whilst these parts project in front of the body in the *Ixodidae*.

Not only do the members of these two families differ in appearance, but also in life history and habits. Ticks of the family *Ixodidae* all have a similar life history, which is illustrated in the diagram on Plate IV. The minute tick, as it first hatches from the egg, possesses only six legs, in contrast to the eight borne by the later stages, and is termed a *larva*. This larva crawls up to the top of the herbage or other convenient point of advantage and is brushed off by its host (*i.e.*, the animal on which it feeds). It then inserts its mouth-parts into the skin and commences to fill itself with blood. Its own skin is capable of distention, and as it feeds the larva swells up, finally becoming completely engorged. It now stops feeding and may either drop off on to the ground or remain attached to its host by its mouth-parts. In either case the second stage of the tick gradually forms within the loose skin of the larva, the skin is finally ruptured or *moulted* and out

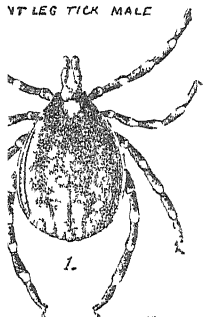
crawls the tick in its second stage. It is now seen to possess eight legs instead of six, and is termed a *nymph*. If the moult has taken place on the host the tick has only to wait until it is sufficiently hardened before "biting in" and commencing to feed again. If the moult has taken place on the ground the nymph repeats the performance of the larva, crawling up to a place of advantage and waiting until it is brushed off by one of its hosts, when it once more attaches itself and commences to feed. Like the larva it feeds to engorgement and becomes greatly swollen. Again the tick may detach itself or remain on the host and the moulting process is repeated. The ticks which emerge from the nymphal skin are now in the adult stage and for the first time the sexes are distinguishable, as already pointed out, by the back of the male being covered by the horny shield and the much smaller shield borne by the female. Shields similar in proportion to those of the females are as a matter of fact borne by both the larva and nymph, and presumably serve some purpose, such as supporting the head whilst leaving the bulk of the tick's skin soft and capable of great distention. Both the male and female attach themselves to their hosts and suck blood, but the male feeds comparatively little and does not gain conspicuously in size, whereas the female becomes greatly swollen and finally fully engorged. The female then detaches herself and falls to the ground, crawls into a convenient shelter, and soon commences to lay eggs. Several thousand eggs are produced, and in the process the female tick gradually shrivels and dies. After an interval the eggs hatch, producing larval ticks, and the life cycle recommences.

The common cattle ticks have thus three distinct stages after leaving the egg, namely the *larva*, the *nymph*, and the *adult*. From what has been said concerning the fact that some species drop off for each moult, whilst others remain on the host for one moult or for both, it is obvious that some species may feed upon three different animals during the course of their development, others on two and some only on one. It is usual to speak of them as having a one host, two host, or three host cycle. This difference in habit has, as will be seen, an important bearing on disease-transmission and on the results secured from dipping.

Having thus touched lightly on the fundamental points in the life history of the common cattle ticks, we are now in a position to deal separately with the various species prevalent in this Territory⁸ and their respective peculiarities in regard to disease-transmission. The species differ from one another not only in size, form and coloration, but also in various minor characteristics, very important amongst which is the length of mouth-parts, these organs being very much longer in proportion to the body in some species than in others. This variation in the mouth-parts is clearly shown on Plate I.

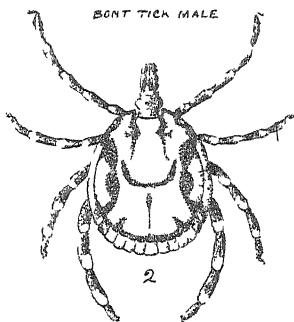
The Bont-Leg Tick (*Hyalomma aegyptium impressum*, C. L. Koch).—This tick, of which the male is illustrated at fig. 1 on Plate I., is probably the best known of all in the Territory. Unfortunately, there is a tendency to use the name "Bont Tick" in reference to it, but this name should be reserved for the species to be

WATERBURY TICK MALE

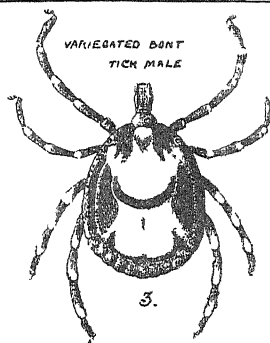


1.

BONT TICK MALE



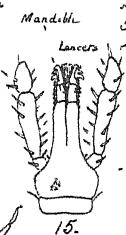
2.

VARIEGATED BONT
TICK MALE

3.



BROWN TICK MALE



15.



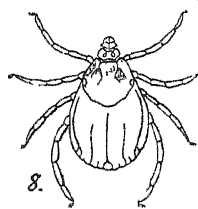
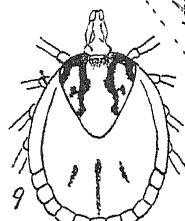
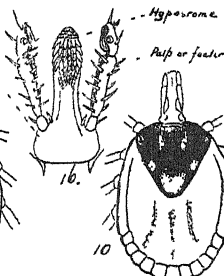
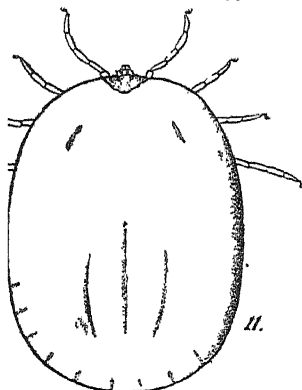
BLUE TICK MALE

HEAD OF TICK
MAGNIFIED

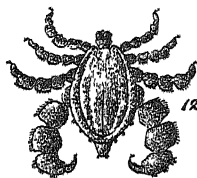
DOG TICK MALE



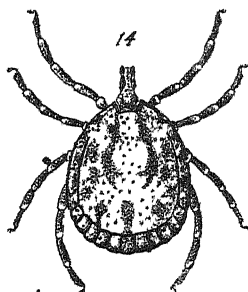
RUSSET TICK MALE

WM TICK FEMALE UNFED, SHOWING
SHIELD.BONT TICK FEMALE
UNFED, SHOWING SHIELD.VARIEGATED BONT TICK FEMALE
UNFED, SHOWING SHIELD.

BROWN TICK FEMALE FED.

SHIELD OF TORTOISE
TICK FEMALE

HORSE TICK MALE.



TORTOISE TICK MALE.

ALL THESE FIGURES ENLARGED
FOUR TIMES EXCEPT 15 & 16.

considered next. The Dutch word "Bont," meaning "parti-coloured" or "piebald," obviously applies only to the legs of this species, the body of the tick being uniformly dark brown. The species is readily distinguished by its banded legs and dull brown body, the surface on the male being closely shagreened all over. The unfed female is very similar in appearance to the male, in fact in this species the sexes are rather difficult to distinguish without the aid of a hand lens, as the female shield, with its rough surface, merges somewhat inconspicuously into the remainder of the tick's back, with which it is uniform in colour. The males and unfed females measure up to nine thirty-seconds of an inch in length, including the mouth-parts. The fully engorged female may measure some three-quarters of an inch in length by five-eighths of an inch in breadth.

The life history of the Bont-leg tick is of the two host type, the moult between the larval and nymphal stages being passed on the host, and that between the nymphal and adult on the ground.* Although the adults are common parasites of cattle and other stock, the larvæ are not known to attach themselves to these animals, but have been reared successfully on rabbits and fowls. To these hosts they attach themselves in the region of the head. The common hare is no doubt a great factor in keeping up the numbers of these ticks on cattle runs, but other rodents must play a part, and in any case the range of hosts of the tick in its early stages is imperfectly known.

The Bont-leg tick has not as yet been found guilty of transmitting any specific disease. Its attack, in the adult stage, has, however, a notorious tendency to cause abscesses and sloughing of the skin, and spots affected in this manner are believed to be specially liable to form the starting points for the so called "Screw Worm" (*Pycnosoma* sp.) which has caused so much trouble amongst cattle of recent years.

The African hosts recorded for the adults of this species include the domestic ox, Cape buffalo, dromedary, rhinoceros, horse, ass, giraffe, sheep, goat, pig, dog, cat, man, domestic fowls and ostriches. The larvæ and nymphs are recorded from hares, rabbits, fowls, ostriches and other birds.

The Bont Tick (*Amblyomma hebraeum*, Koch).—The male of this species is easily recognised by the pattern on the shield, the dark markings being dark brown, nearly black, and the lighter portions pale green in the middle merging into pale yellow towards the edges (see Plate I., fig. 2). The legs are banded as in the preceding species. In the female the markings on the shield are more variable. The plan of the markings on a specimen in the writer's collection is shown at fig. 9 on Plate I. Prof. Neumann, the French authority on ticks, described the shield as exhibiting a large light spot towards the hinder end, and other small ones towards the sides. The remainder of the back of the tick in the unfed female is dark brown.

*Recent research has shown that this species may or may not drop off for the first moult, so that its cycle is of either the two host or three host type. Individual variation in habit of this nature has not been noted in connection with other ticks.

The length of the males and unfed females, including the mouth-parts, is about one-quarter of an inch, and the breadth about three-sixteenths of an inch. The engorged female usually measures about three-quarters of an inch long by five-eighths of an inch in breadth.

The life history of the Bont tick is of the three host type, both moults being passed through away from the host. The larvæ and nymphs feed on the same hosts as the adults. The duration of the different stages has been worked out in detail by Mr. C. P. Lounsbury in the Cape Colony. The female tick lays an enormous number of eggs, upwards of 17,000 having been computed in a single batch. The incubation period of the eggs varies very greatly with the temperature. In the winter it may occupy six months or more, and in the summer a period of about eleven weeks has been noted. The larva feeds for from four to nine days, but usually six or seven, before detaching itself, to drop to the ground for its moult. At this stage of its development it measures about one-twelfth of an inch in length. The time occupied in the moulting process varies in relation to the temperature and possibly other factors. It has occupied as little as sixteen days, when the ticks were kept in an incubator, and several months during the winter at ordinary atmospheric temperature. In nature it is thought that the period would vary between one to three or more months. The nymph or second stage tick engorges in from four and one-fourth to eight days, and like the larva drops to the ground for the ensuing moult. Lounsbury mentions periods of eighteen, twenty-two, twenty-four and twenty-eight days for this second moult, but adds that the time varies considerably with individuals, some treated in exactly the same way taking a fortnight longer than others over the process. This second moult brings the tick to the adult stage. The females only bite in readily next to a male that has been attached for some days. They then take some seven or eight days to feed to repletion and drop off to lay their eggs on the ground. The males remain attached to the host for a prolonged period.

As far as the complete "life cycle is concerned, Lounsbury judges that in the Cape Colony there cannot be more than one complete generation in a twelve month, and that "under exceptional circumstances two full years might pass and the cycle be still incomplete."

The Bont tick is found mainly in south-eastern and eastern Africa. It is not known to occur naturally in Southern Rhodesia, but males have been taken from animals introduced from the South African Union some months earlier under conditions that leave a doubt as to whether the infestation took place in this Territory or not. The Bont tick is found in Bechuanaland, and there seems no reason why it should not become established in parts of this Territory, except that it must have been introduced freely in the past, and is not yet in evidence.

The Bont tick was shown by Lounsbury to be the transmitter of the disease known as Heart-water, which attacks sheep, goats and calves in parts of the South African Union. The tick conveys the

disease from stage to stage, and not through the egg, that is to say, larvæ and nymphs which feed on a sick animal acquire the virus of the disease, and the resulting nymphs or adults, as the case may be, transmit the disease when they "bite" susceptible animals.

The Bont tick in the adult stage has been recorded from cattle, sheep, goats, swine and horses, amongst domestic animals, and rhinoceros, giraffe, various antelopes, buffalo, lion, wild dog and other carnivora. It has also been found on a "Monitor" lizard.

The Variegated Bont Tick (*Amblyomma variegatum*, F.).—The handsome male of this species is shown at fig. 3 on Plate I., and a diagram of the female illustrating the shield markings at fig. 10. Although the shield markings of the male are on very much the same plan as those of the preceding species, there is no risk of confusing the two. The edges of the shield in the Variegated Bont Tick are dark, whereas those of the Bont tick are pale. Furthermore, the light markings on the shield in the present species are coppery red instead of pale green shading into yellow towards the edges as in the case of the true Bont tick. Entomologists also find a distinction in the "eyes" which are flat in the Bont tick, but prominent and provided with a slight orbit in the "Variegated" species. The dark markings are also distinctly raised above the general surface of the shield, and there is a green tinge at the edges of these markings. The markings on the female shield are very variable, and frequently the whole shield is dark without any light patches. In size and life history, as far as the latter is known, this species resembles the Bont Tick, although the engorged females are recorded as attaining even greater dimensions. This tick is found in certain parts of Southern Rhodesia, notably in the region near the Victoria Falls (Matetsi, etc.) and along the eastern border of the Territory.* It appears to be absent from the central plateau.

This species has lately been shown to be able to transmit Heart-water. It is also reported to be very apt to cause abscesses and sloughing of skin in the host, as also is the true Bont Tick. This tendency, in fact, seems to be common to the large species of ticks furnished with long mouth-parts.

The Tortoise Tick (*Amblyomma marmoreum*, Koch).—The male of this species is shown at fig. 14 on Plate I. and the female shield at fig. 13. The adults are common on reptiles, particularly tortoises, hence the popular name; but they also attack warm-blooded animals. The larvæ and nymphs feed very readily on warm-blooded animals. This species was reared at Capetown during the time the present writer was assistant to Mr. C. P. Lounsbury, and the life history was found to be similar to the Bont Tick, each stage dropping from the host for the moults. The engorged females may attain a considerably greater size than those of the Bont Tick, and the unfed males and females also average rather larger. The Tortoise Tick

*Robinson describes this species from the eastern part of the Territory as a distinct variety—*A. variegatum* var. *nocens*. In a popular article it appears unnecessary, however, to distinguish between the variety and type, as the former conforms to the brief description given above.

occurs in this Territory, but does not appear to be very abundant. It is recorded from the Cape up the east coast to the Congo and in West Africa (Senegal). Neumann records rhinoceros and genet as warm-blooded hosts, as well as tortoise and python.

The Brown Tick (*Rhipicephalus appendiculatus*, Neum.).—The Brown Tick, well known in connection with the transmission of East Coast Fever, is shown on Plate I., the male at fig. 4, the unfed female at fig. 8, and the fed female at fig. 11. There are, however, a number of different species of this genus in the Territory, and most of them resemble the Brown Tick so closely that none but those who have made a study of ticks are likely to distinguish one from the other. With many species even specialists experience considerable difficulty, particularly with the females. The writer has therefore thought it unprofitable to figure more than one species. The Brown Tick is, generally speaking, the commonest cattle parasite of the genus, although the "Black-pitted Tick" (*R. simus*, Koch) is also common on this host, as also is the "Red-legged Tick" (*R. evertsi*, Neum.). The latter is an easily recognised species owing to its saffron coloured legs, the legs of the other representatives of the genus being dark brown. The adults of the *Red-legged Tick* attach themselves by preference under the tail of the host, whilst nymphs are mainly found deep in the ears. On this account, the nymphs have frequently reached the writer with a request for a statement as to whether they are specimens of the Spinose Ear Tick or not. The adults of the Brown Tick are also found on the ears of their hosts, although they do not penetrate so deeply as the Red-legged Tick nymphs, and are also sometimes suspected of being Spinose Ear Ticks. As will be seen later, both forms are very distinct from this latter species, which belongs to the other family of ticks (*Argasidae*).

Both males and females (unfed) of the Brown Tick and its local relations (excluding the Red-legged Tick) are of a uniform dark brown colour. The size is variable. The male from which fig. 4 on Plate I. was drawn measures almost exactly three-sixteenths of an inch in length, and this is about the maximum size. Many specimens are much smaller. It is noteworthy that specimens taken from antelope and other wild animals all appear to be on the small side. The specimen figured was taken, in company with others of similar dimensions, from cattle at Salisbury, the unfed females of the same batch being rather smaller.

The name *appendiculatus*, given to this species by Prof. Neumann, refers to the prominent projection on the hinder margin of the male. This may develop, but does not always do so, as the tick feeds, being absent in unfed specimens. Other species of the genus also develop projections, but usually less prominent than that of the Brown Tick. This peculiarity is also found in the genus *Margaropus*, which includes the Blue Tick, to be dealt with later.

The life history of the Brown Tick and several other members of the same genus has been worked out in detail. The other members include the Black-pitted Tick (*R. simus*, Koch), the Cape Brown Tick (*R. capensis*, Koch), and the Red-legged Tick (*R. evertsi*). The

Cape Brown Tick is not known to occur in this Territory. Of the four species mentioned three show life histories of the three host type, falling from the host for both moults. The Red-legged Tick has, however, a two host cycle, remaining on the animal for the first moult, but falling off for the second.

The Brown Tick larva may occupy as little as three days in feeding to repletion, but frequently takes considerably longer. When full fed it is about the size of a pin's head, and drops off for its moult, which may take a fortnight or more, depending on the temperature, etc. The resulting nymph after attaching itself to an animal feeds to engorgement in some 4—6 days or longer, and again falls off for the moult, being now about the size of a lentil. The female, providing she meets a male at once, swells to repletion in about nine days, and drops off to lay her eggs on the ground. The swollen female is about the size of a castor bean, and may be distinguished from the Blue Tick female by its dark brown legs and bluer colour, the Blue Tick having pale legs and a somewhat greenish tinge. The time occupied by the moults and hatching of the eggs varies greatly with the time of year, and Lounsbury estimates that not more than two full generations can be passed during the year under the most favourable circumstances.

The above notes apply to the other species of the genus which have been studied, with the exception of the Red-legged Tick. In this species the nymphs begin to fall from the ear about ten days after the larvæ have "bitten in," and the larval and nymphal stages are thus passed in a considerably shorter time than in the case of species which fall off for the first moult.

The four species of this genus mentioned above have all been found capable of transmitting East Coast Fever, and it is probable that some, if not all, other members of the genus are capable of playing a similar part. The method of transmission is similar to that of the Bont Tick and Heart-water. A tick feeding on a sick animal in the larvæ stage and "biting" a susceptible animal in the nymph stage may convey the disease, as may also occur if the nymph feeds on a sick animal and the resulting adult feeds on a susceptible animal. The disease does not pass through the egg stage, and recovered animals have under test invariably failed to infect ticks. It is noteworthy that if a larva feeds on a sick animal and the resulting nymph engorges on an animal, such as a dog, hare, goat or sheep, which is immune to the disease, the infection is lost and the adult is not capable of infecting a susceptible animal.

The Brown Tick has recently been shown to transmit Redwater in cattle either as an adult, which fed on an infected animal in the nymphal stage, or as a larva, whose mother fed on an infected animal. It can also transmit the form of gallsickness in cattle caused by the organism *Gonderia mutans*, but the mode of transmission in this case is not stated.

The Red-legged Tick can also transmit gallsickness caused by *Gonderia mutans*. It plays a more important role, however, in transmitting biliary fever of the horse. These diseases are transmitted by

the adults which have fed on infected animals in the larval and nymphal stages, both of which, as already stated, are passed on one host. In addition to the above, the larvæ can transmit ordinary Redwater in cattle and the disease known as *Spirillosis* caused by *Spirochæta Theileri*, affecting cattle, sheep and horses, when the mother tick has fed on an infected animal.

The Black-pitted Tick can transmit ordinary gallsickness (anaplasmosis) amongst cattle.

The European Brown Tick has been shown in India to transmit biliary fever of the dog, which it may do in three ways, at least:— (1) adult females feed on an infected animal and the nymphs of the next generation are infective; (2) nymphs feed on an infected animal and the adults are infective; and (3) adult females feed on an infected animal and the adults of the next generation are infective.

It will be seen, therefore, that ticks of the genus *Rhipicephalus* are amongst the most important in regard to disease transmission.

The following is a list of the species of the genus which have been collected in Southern Rhodesia and identified, together with the African hosts recorded in respect to each:—

(1) *Brown Tick* (*R. appendiculatus*, Neum.).—Ox, sheep, goat, horse, ass, Cape buffalo, dog, koodoo, sable antelope, wart-hog.

(2) *Black-pitted Tick* (*R. simus*, Koch).—Dog, lion, horse, ox, Cape buffalo, dromedary, S.A. river-hog, wart-hog, porcupine, bush-pig, sable antelope, koodoo, cat.

(3) *Red-legged Tick* (*R. evertsi*, Neum.).—Ox, horse, ass, mule, zebra, sheep, goat, giraffe, dog, jumping shrew, sable antelope.

(4) *European Brown Tick* (*R. sanguineus*, Latr.).—Dog, jackal, civet-cat, lynx, cat, lion, man, hare, hedgehog, dromedary, waterbuck, sheep, goat, ox, scaly ant-eater, ostrich, owl, ibis, tortoise. This tick is very common on dogs at Salisbury and in other parts of Mashonaland.

(5) *R. sulcatus*, Neum.—Dog.

(6) *R. supertritus*, Neum.—A number of specimens were collected in 1910 off the grass near Gatooma, where the species appears to be common, but the host is not known to the writer.

The Blue Tick (*Margaropus decoloratus*, Koch).—This species is readily distinguishable from other common cattle ticks by its pale legs. The male and unfed female are considerably smaller than the species already dealt with, although the fully engorged female is not so markedly inferior in size to engorged Brown Tick female. The male measures roughly about one-eighth of an inch in length, and is of a greenish blue colour, with a well developed "tail" when fed, as in the Brown Tick. The points of the plates on the under surface of the body frequently show when the fed male is viewed from above (see Plate I., fig. 5). The fed female is somewhat greenish blue in colour in contrast to the slaty blue of the Brown Tick female, and the shield is smaller. The easiest guide lies, however, in the pale legs.

The life cycle of the Blue Tick is confined to a single host, the tick remaining in position for *both* moults. The cycle is a rapid one compared with most other ticks, as the natural heat of the host causes the tick to be much less influenced by the weather during the moults. The fully fed females usually commence to fall about twenty-one days after the larvæ have "bitten in," but the bulk appear to mature between the twenty-third and the twenty-fifth day. The female, of course, lays her eggs, like other ticks, on or in the ground, and their hatching period is influenced by atmospheric conditions. Under natural conditions there are, however, undoubtedly several generations during the year, and in the absence of dipping the Blue Tick is, as a rule, the commonest species. On the other hand, where dipping is practised it tends to disappear sooner than any other species on account of the lengthy period it spends on its host at a time, which exposes it to repeated treatments.

The Blue Tick transmits the cattle diseases Redwater and Gall-sickness (anaplasmosis). It has also been shown to be an agent in the transmission of Spirillosis, affecting horses, cattle and sheep. The disease is taken up by the tick when feeding on a sick or recovered animal, and is conveyed by the larvæ of the next generation when they attach themselves to a susceptible animal. The infection thus passes through the egg stage.

This species has been recorded on the following animals:—Ox, horse, sheep, goat, dog, koodoo, impala, sable antelope.

The Horse Tick (*Margaropus withemi*, Karsch.).—This relative of the Blue Tick is not known to occur in Southern Rhodesia, but may do so. It is a South American species, and probably came to Africa with horses from the Argentine during the Boer War. Little is known concerning its habits. It was first found in South Africa infesting horses in the Cape Colony, and was described by two separate authorities as a new species under the names of *Ehipicephalus phthirioides*, C. & R., and *Margaropus lounsburyi*, Neum. The bizarre form of the male (see Plate I., fig. 12) suffices to distinguish it from other known ticks, but the females are superficially similar to, although somewhat larger than, the common Blue Tick. The legs have, however, a striped appearance through the presence of dark markings towards the outer end of each article.

The tick has been recorded on horses and cattle and has been introduced to this Territory in the past. The specimens, in the writer's collection were taken on cattle imported from Middelburg, Cape Province.

The Dog Tick (*Hæmaphysalis leachi*, Aud.).—This is probably the commonest tick found on the dog in this Territory as elsewhere in South Africa, but dogs are sometimes seen much more heavily infested with *R. sanguinius* or *R. simus* adults.

The male of the dog tick (see Plate I., fig. 6) is about the same size as that of the Blue Tick, but is of a uniform brown colour, including the legs. The engorged female attains very much the same size as that of the Blue Tick, but is more slaty blue in colour.

Although distinguishable at a glance from the Brown Tick and its allies to those familiar with the characteristics of ticks, there is no very broad distinction to guide the uninitiated. The head of the Dog Tick is, however, shorter and broader than that of the Brown Tick, the male does not develop a "tail," and the shield on the male bears a deep uniform groove close to and parallel to the edge, completely bordering the shield except in front.

The life cycle of the Dog Tick is of the three host type, the tick falling off for both moults. There are probably two generations during the year as in the case of the Brown Tick.

The Dog Tick is known to transmit the disease known as Malignant Jaundice or Canine Piroplasmosis. The disease is closely related to Redwater in cattle. The mode of transmission discovered by Mr. C. P. Lounsbury at the Cape is unique. Adult females fed on a sick or recovered animal take up the infection, but the larvæ and nymphs of the next generation are, as a rule, incapable of transmitting the disease. When the adult stage is reached, however, the ticks are infective and capable of giving the disease to a susceptible animal, if they happen to attach themselves to such.

The hosts recorded for this tick are mainly carnivora, namely:—Domestic dog, jackal, domestic cat, lion, leopard, genet, civet-cat, mongoose and scaly ant-eater.

The Russet Tick (*Ixodes pilosus*, Koch).—The popular name given to this species refers to the colour of the engorged female, which is of a russet rather than the usual bluish colour of ticks of similar size. The males measure about one-tenth of an inch in length including the mouth-parts, and the species is the smallest with which we have to deal. The engorged female is of a peculiar shape, being considerably broader behind than in front. The male is figured on Plate I. at fig. 7, and may be recognised by its small size, the long narrow mouth-parts, the brown colour, the deep groove round the shield, and the absence of festoons on the posterior part of the shield. The long narrow mouth-parts and the colour also serve to distinguish the female. This species was reared years ago by Mr. C. P. Lounsbury at the Cape, and found to drop off for both its moults, having thus a three host cycle. All the specimens in the writer's collection were taken on the domestic dog, and it is possible that the tick may also be concerned in the transmission of Malignant Jaundice. An allied species (*I. ricinus*, Linn.) transmits Redwater amongst cattle in Europe. The Russet Tick is stated to cause a disease of sheep of the nature of paralysis in the Cape Province.

In addition to the dog the following hosts are recorded, and it may be stated that experience elsewhere does not indicate the dog as necessarily the favourite host, the tick being found abundantly on cattle and small stock—cattle, mules, horses, pigs, goats, sheep, bushbuck, duiker, cat and leopard.

(To be continued.)

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc.

The Customs returns for the first four months of the year show an export from Southern Rhodesia of 2,404 slaughter cattle against 7,319 head for the corresponding period last year, or less than one-third the number. Our exports are not only failing to keep pace with our increase, but are actually diminishing, the figure for April being only 189 head, as against 2,404 for April last year. There is thus a surplus piling up which must find an outlet some day at any price. This price will determine also very largely the price of land, the price of cattle and the spending powers of a large section of the community, and must therefore materially affect the prosperity of the country.

As an outcome of the special memorandum which appeared in the last issue of this Journal, we have received several helpful criticisms and suggestions which are welcomed as helping in the general discussion of the subject which is so very desirable.

One afterthought is that perhaps the very important question of veld fires did not receive adequate attention. The loss of grazing and the deterioration of the veld through this cause should have been mentioned, and the fact emphasised that this evil is lessening as the country is becoming more stocked, whilst in time the carrying capacity of veld properly grazed and not annually burnt is materially increased. The increase of cattle, the spread of population and a better understanding of the subject are having a marked effect already, and one which must have a cumulative benefit.

In dealing with possible sites for freezing works, the claims of Hartley were overlooked. The facts should have been stated that Hartley lies very centrally for the whole Territory and for the district of that name, which contains a number of ranches and much good but undeveloped pastoral land. The township possesses a large commonage with suitable sites for meat works, and the railway here crosses one of the principal rivers of the country, so that the possibilities of this township deserve consideration when the question of location of meat works is being dealt with.

A clerical error appears in the table on page 14 dealing with the number of cattle in Southern Rhodesia. The rate of total increase for that year is 13 per cent. and not 16 per cent. as shown. Reference has been made to the method of showing the increases for each year in this table. The figures under the headings "Rate of Increase" represent the increases for the year opposite which they stand; for instance, the rate for the year 1914 was 10.2 per cent., and that for 1920 was 12.0 per cent.

The rate of increase and the results of calving vary according to the system of counting pursued on different ranches, and this leads to occasional misinterpretation of returns and to apparent inconsistencies between statements from different sources, occasioning some confusion.

Other observations on this subject with a view to amplifying and correcting our knowledge will be welcome.

The public generally understand the circumstances which have led to the creation of the Meat Producers' Exchange, an effort by the producers of meat in South Africa to increase their share of the proceeds realised from the sale of live stock, and at the same time to endeavour to lower the cost to the consumer. In this trade an unnecessary number of intermediates has of late years arisen, and a shortening of the circuit between producer and consumer appears to be necessary. The patience of the farmer at the one end of the chain and the townsman at the other is exhausted, and it seems likely that the superfluous dealer, agent, speculator and salesman will be summarily dispensed with. The natural results of good seasons, control of disease, better methods, particularly the extension of dipping and the improvement in bulls, are combining to produce a supply of marketable cattle beyond our own needs. The surplus is accumulating, and being of a perishable nature, it cannot be held indefinitely, but must be realised as the cattle reach maturity; hence a fall in prices and a reduction in the margin of profit which necessitates the adoption of more economical methods of disposal. This surplus renders it necessary to find markets overseas, and it is a striking fact that there exist facilities for the export of frozen meat at Capetown, East London, Durban and Lourenco Marques greater than the supplies within reasonable reach of these ports at present warrant, whilst there are large quantities of cattle being raised and fattened in parts of South Africa, including Rhodesia, at distances too great for them to be advantageously sent to these points for export. Already the journeys of live stock are much greater than are permitted in other countries. The difficulties of distance are not to be adjusted by a reduction of railway rates or by brief halts for resting and water. The practical man knows the losses incurred in railing stock; and the deterioration of the quality of the meat, as well as the loss in weight, alike testify to the exhaustion and suffering of the animals. The only solution appears to be in the establishment of freezing works at inland centres, so that cattle can be dealt with nearer to their pastures. The frozen product could then be conveyed to the coast in a concentrated and comparatively imperishable form pending shipment. This is one of the most pressing needs of Southern Rhodesia at the present moment.

Farm Butter Making.

By T. HAMILTON, M.A., N.D.D., N.D.A., Dairy Expert.

Although creamery butter to the approximate value of £40,000 has been exported from Rhodesia during the last twelve months, a large amount of farm butter for local consumption continues to be made. A good deal of this butter, especially in the summer season, is of a low grade quality, and therefore it would seem likely that an article on farm butter making may be of value to farmers.

Utensils Required.—(a) *The Churn.*—The end-over-end type of churn is recommended. This should be made of well seasoned oak, fitted with means of ventilation and with a small window through which the state of the cream can be observed without removing the lid. The lid should be of sufficient size to enable the contents to be removed without any difficulty. The churn must, of course, be kept scrupulously clean and sweet, and when not in use should be filled with clean cold water. Metal churns, when butter is only occasionally made, are serviceable, but their design precludes them from having the advantages of the old-fashioned wooden end-over-end type.

(b) *Butter Worker.*—This should be fitted with a roller, by means of which water can be expelled from the butter. It is almost impossible to work any quantity of butter by any other means. Insufficient working causes the retention of large quantities of water or buttermilk, thereby causing the butter to be of an inferior quality.

(c) *Scotch Hands, Butter Scoops, etc.*—These are made of wood, and, like the churn, are scalded and kept sweet and clean when not in use.

Preparation of a New Churn.—Fill the churn with lukewarm water and allow to soak for at least twelve hours. Should the churn leak, the water must be replaced. Wash with hot water in which ordinary washing soda has been dissolved. This will remove all the natural brown stain from the wood. Wash again with lukewarm water and again with cold. Scald with boiling water, and give the churn a few turns, taking care to press the ventilator after each turn. If the preparation is complete, the water should come off quite clear. The churn should then be well scrubbed with salt and filled with clean cold water. A new butter worker should be treated in a similar manner.

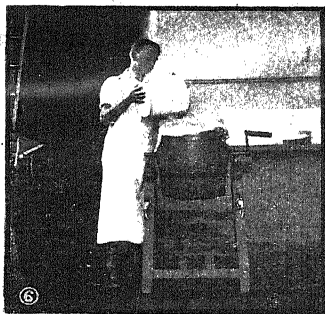
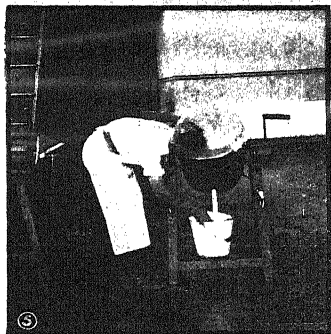
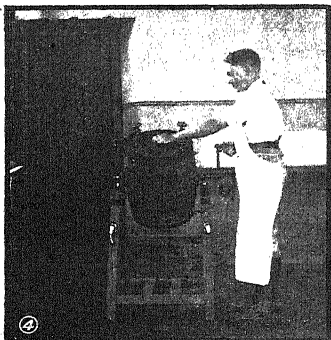
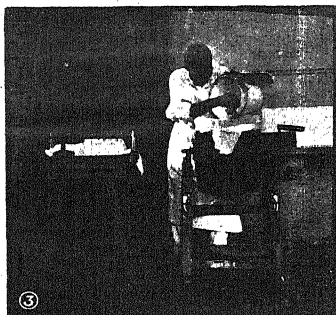
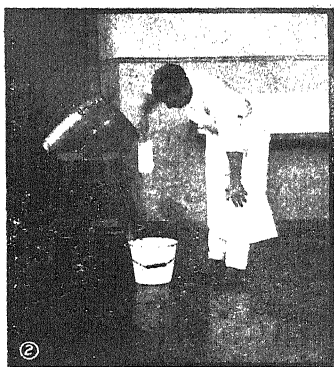
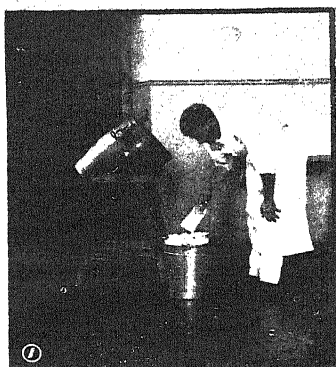


Fig. 1.—Method of warming up cream to help on souring during cold months. The bucket of cream is placed in another bucket of warm water. Fig. 2.—How the cream should be before putting into churn, viz., able to run freely off a wooden stick. Fig. 3.—The cream should be strained into the churn, and any sticking to the sides of the bucket taken out with a squeegee. This shows how the butter worker should be left when the churning is going on. Fig. 4.—The churn should be ventilated every few turns for the first five minutes. Fig. 5.—The buttermilk and washing water should be strained through a sieve over which a piece of muslin has been tied. While this is going on the mouth of the churn should be covered over with a wet cloth. Fig. 6.—The salt water should always be strained through a cloth to take out particles of dirt.

Preparation of Cream for Butter Making.—Bulletin No. 356. "Cream and its Production," gives full instructions for the preparation of cream either for churning or for despatch to a creamery. Owing, however, to the amount of inferior cream produced on farms throughout the Territory, a recapitulation of the points detailed in the bulletin will perhaps be of service.

To obtain a First-Grade Cream.—

1. Observe every precaution to ensure the production of clean milk.
2. See that the separator is properly mounted and properly manipulated.
3. After using the separator, take out the working parts, wash them in warm water, using a brush, and then scald in boiling water. Never assemble the parts until immediately before use.
4. Always use two receptacles when handling cream for farm butter making, the first for receiving the cream from the separator and the second for storing and ripening cream.
5. Always cool the cream immediately separation is complete by immersing the vessel containing it in cold water.
6. Never mix warm cream with cold cream.
7. Keep the cream in an open can or jar, covered with clean muslin.
8. If butter is made only once a week, keep the cream as cool as possible by allowing the cream can to stand in cold water.
9. Stir the cream at least three times a day.
10. Keep the cream in a clean airy dairy where the atmosphere is pure and untainted.
11. When sufficiently ripe for butter making, cream should have a clean, sharp acid flavour and a smooth velvety appearance. The acidimeter test should show about 5 per cent. development of lactic acid.

Preparation of Utensils for Butter Making.—*The Churn.*—Scald with boiling water, giving only half a turn before allowing the steam to escape through the ventilator. Then give another turn, and, removing the lid, run off the hot water as quickly as possible and replace with cold water. Give one or two turns, and allow the churn to hang with its lid hanging downward. During the greater part of the year in Rhodesia it is necessary to prepare the churn the evening previous to butter making, filling it with the coolest water obtainable (from water bags for preference) and, removing the churn outside the dairy, expose it, with lid removed, to the night air.

The Butter Worker.—Scald the butter worker with boiling water, paying particular attention to the scalding of the roller. Run the boiling water off, and whilst it is still running, pour on cold water. Run the cold water off, and scrub with salt, leaving some damp salt on the roller. Replace plug and fill the worker with the coldest water obtainable, giving the roller a turn round in the cold water and covering it with a wet muslin cloth which hangs over into the water. Expose to the night air in warm weather.

Preparation of Cream for Butter Making.—The thickness or consistency of the cream, its appearance, its degree of ripeness and its temperature are most important. When cream is ready to churn, it

should not be too thick. If it is in this condition, add cold water until it runs off a wooden stirrer without clinging to it. If the cream is too thick it will stick to the sides of the churn, and cause difficult churning and a loss of fat in the buttermilk.

The Churning Temperature.—This is of extreme importance. *It is always necessary to use a thermometer in butter making, as control of temperature is one of the most important points to be considered in successful dairying.* The following temperatures may be found a help:

Temperature of Dairy.	Churning Temperature.
66 degrees F.	55 degrees F.
64 degrees F.	56 degrees F.
62 degrees F.	57 degrees F.
60 degrees F.	58 degrees F.
58 degrees F.	59 degrees F.
55 degrees F.	60 degrees F.
50 degrees F.	62 degrees F.

When the temperature is either too low or too high, undesirable results are obtained. A low temperature prolongs the churning period unnecessarily, and may even make it impossible to churn the butter. It causes the granules, especially when the cream is thin, to form tiny pellets like fine shot. The working of the butter and the incorporation of the salt are accomplished only with great difficulty, and the "body" of the butter is spoiled.

Adding hot water to the cream in winter is a bad practice, as it causes a week-bodied greasy butter and a loss of butter fat. The only satisfactory method of warming the cream to the proper churning temperature is to put the bucket or jar containing the cream into a tub or tank of water at a temperature of about 95 degrees, and replace the water when cold. The cream during the warming-up process must be stirred frequently, in order that it may be warmed uniformly throughout. It is, however, more necessary in this country to cool the cream than to heat it up, and the absence of any cooling plant or refrigerator on farms makes it a most difficult matter. However, some means should be devised to lower the temperature as much as possible. One of the most common as well as perhaps the most effectual is to hang the cream can, jacketed with a wet flannel or sacking cover, somewhere in a shady place where it is exposed to any breeze that may be blowing. The jacket round the can should be kept thoroughly wet, and this treatment will result in favourable weather in a lowering of the temperature to as much as 10 degrees below air temperature. In order to reduce the temperature as much as possible, it is always advisable to divide the cream into several lots, say of about 1½ gallons each, and cool it as already described. A quicker lowering of temperature will result than if the cream is cooled in bulk. At the same time, cold water from water bags should be used to thin the cream. If the churning is done just before daybreak, a satisfactory grain should be obtained, as it is perfectly feasible, by this means, to reduce the churning temperature to about 60 degrees F. Most butter made in the summer months is of poor quality, because very little attempt is made to control the churning temperature, with the following results:—

1. *Loss of Butter Fat in the Buttermilk.*—When the churning temperature is high enough to reduce the churning period to 10 or 15 minutes, the loss of butter fat may be as much as 2 per cent.; whereas, under proper conditions, the loss does not exceed 0.2 per cent.

2. *The Quality of the Butter is Injured.*—

- (a) Too much buttermilk is left in the butter. When the butter granules are so soft that they stick together in large masses, the washing out of the buttermilk is impossible, and large quantities are incorporated with the butter. Such butter has poor keeping qualities, and bad flavours are developed. These bad flavours are caused not by the decomposition of the butter fat, but by the decomposition of either the casein or white matter locked up in the butter.
- (b) Too much moisture is left in the butter. This appears as large drops when the butter is cut and pressed between the Scotch hands. Many farm butters made in the summer contain as much as 25 per cent. of moisture, whereas the legal standard for moisture content in farm butter in most countries is a maximum of 18 per cent. and in creamery butter 16 per cent.
- (c) A weak, greasy body is caused in the butter. Butter properly made at the correct temperature has a firm, waxy body, and is close in texture.
- (d) White streaks appear in the butter, due to the inability of the butter maker to wash out the excess buttermilk.

If the proper temperature is observed, the churning period occupies from 25 to 35 minutes. Patent churns which churn butter in seven to ten minutes produce the harmful results already described.

Putting the Cream into the Churn.—The cream, when of the right consistency and temperature, should be poured into the churn through a straining cloth. This will have the effect of breaking up any lumps and also of removing any curd particles which, if not removed, will cause white spots to appear, and also cause the butter to develop bad flavours. The bucket is cleaned by means of the squeegee, and any cream remaining in the straining cloth squeezed through into the churn. The churn should never be filled to more than about one-third of its capacity.

Churning.—Begin churning slowly, and ventilate every twenty revolutions until no air or gas escapes when the ventilator is pressed. Then increase the rate of turning to that fixed for the type of churn used, and turn regularly until the cream "breaks" and the granules of butter appear on the glass. The sound made by the cream in concussion indicates also that the butter is being formed. The churn should then be revolved slowly several times and stopped, and the butter examined to guard against overchurning. If the grains are sufficiently large, add a quart or more of breaking water at a temperature (if possible) 2 degrees lower than the churning temperature. Give two or three slow turns to make the grains rounder; when finished, they should have the appearance of mustard seed, and should be the size

of rather large shot. When the grain is of the right size, draw off the buttermilk, using a hair sieve (covered with butter muslin) to catch any grains which may be washed out with the buttermilk.

Washing the Butter.—The object of washing is to remove the buttermilk, and whilst the last of the buttermilk is draining from the churn the washing water should be prepared. Clean cold water only should be used. It should be about 4 degrees lower than the churning temperature. In summer the coldest water obtainable should be used for this purpose, and if salt is used to form a weak brine, so much the better, as the addition of salt will bring down the temperature from 1 to 2 degrees. After the plug is put back, the washing water should be poured into the churn and the lid replaced. Four to six sharp turns are then given. The washing water is drawn off and the washing repeated. Two washings are enough, as excessive washing has the effect of bleaching the colour and causing loss of flavour.

Salting Butter.—Brine salting is recommended for fresh farm butter. A brine made in proportion of one pound of salt to one gallon of water will give a sufficient degree of salting for most markets if the butter is left in the brine from 15 to 20 minutes. A stronger brine left in the butter for a longer period will give a more highly salted butter. The brine should always be strained into the churn, to prevent specks of dirt or granules of undissolved salt getting into the butter.

The Advantages of Brining.—

- (1) The addition of salt to the water brings down its temperature about 2 degrees, and this in the summer firms up the grain to a very considerable extent.
- (2) It improves the flavour, and, being evenly distributed, obviates the formation of white streaks through the butter.
- (3) The butter requires less working, and can be made up at once.

Dry Salting.—Dry salting is not recommended, although it economises salt. Dry salting very often results in white streaks being formed, and the butter is often full of particles of undissolved salt. The amount of salt varies according to taste. One-half to three-quarters of an ounce of salt to one pound of butter will give a fairly heavy salting, but these proportions can be exceeded if so desired. Good salt must always be used, and it should be free from dirt, and should remain dry for a considerable time if kept in a suitable place. When used for dry salting, it should be ground to a fine state of division, and sprinkled on the butter through a hair sieve in two or three portions in the manner described under the head of "Preserving Butter."

Removing Butter from Churn.—The butter after remaining for about 15 to 20 minutes in the brine should be removed from the churn by means of a butter scoop on to a sieve covered with butter muslin. The sieve is held over a bucket which catches the drippings, and when the sieve is full the butter is transferred to the butter worker. If all the butter cannot be removed from the churn at one operation, the butter already in the worker should be covered with a wet muslin cloth until the next portion is placed with it. The few grains of butter which cannot be gathered, or which cling to the sides of the

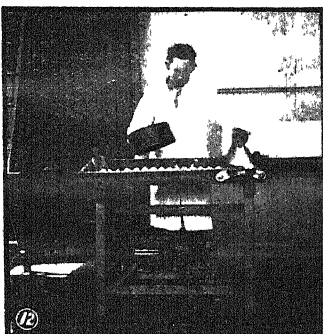
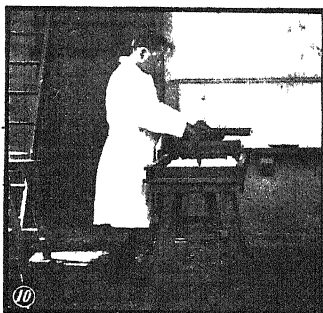
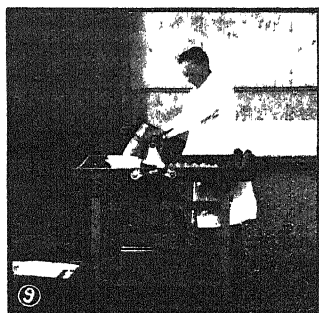
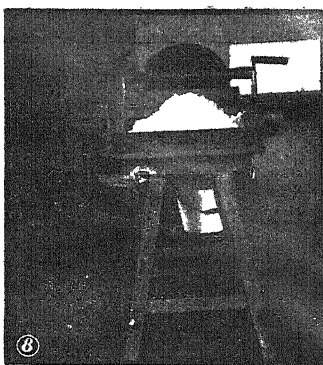
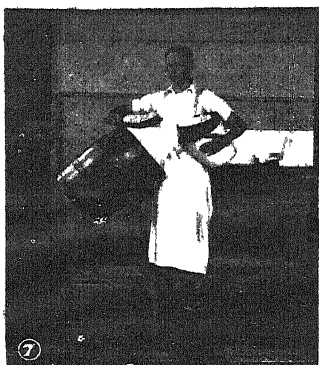


Fig 7—The butter should be removed from the churn before the last washing water is withdrawn by means of a scoop into a sieve and then taken over on to the butter worker. Fig. 8—Butter should be in this state before it is worked, viz., in a granular state and free Fig. 9.—The roller is pressed gently over the butter and this process must not be done roughly Fig 10—After the butter has been rolled it should be cut into two pieces with the Scotch hand and (Fig. 11) rolled up away from the rollers The lump is then put under the rollers and worked again. Fig 12—The salt should be added through a dry sieve.

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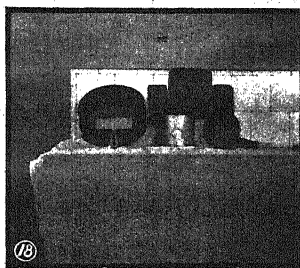
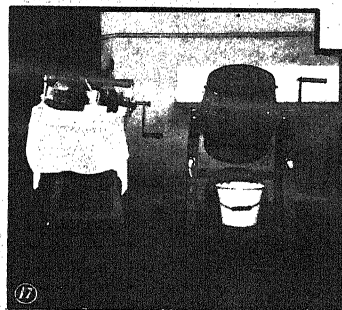
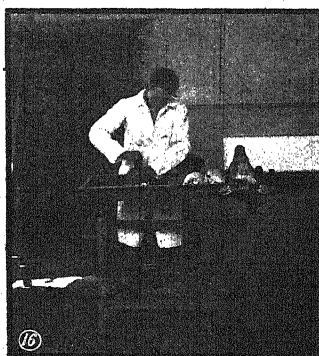
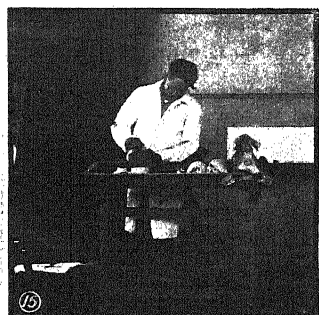
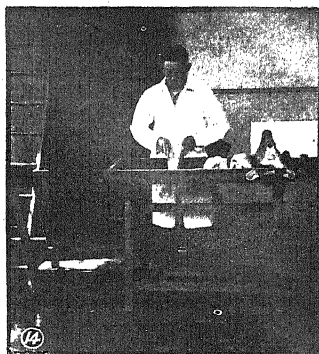
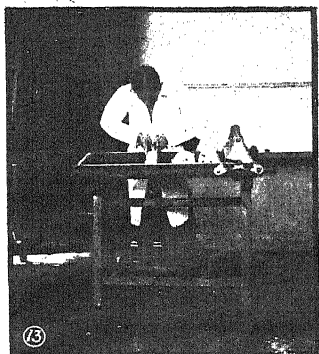


Fig. 13.—When it is thought that the butter has been worked enough a small piece is taken and broken open and the texture examined. Fig. 14.—In order to see if enough moisture has been worked out, take a small piece of butter, cut it in half and squeeze the smooth part between the Scotch hands. No more than a few drops of water ought to come out. Fig. 15.—By using a mould, butter may be made up into 1lb. blocks in a very short time. The mould is pressed down gently into a lump of butter and (Fig. 16) the outer part raised, when it will be found that a pound of butter has been nicely shaped. Fig. 17.—This is how the churn and butter worker ought to be left after washing up, so that every part can get thoroughly dry. Fig. 18.—Accessories used in butter making, viz., Scotch hands, beaker, squeegee, scoop, thermometer and sieve.
(Reproduced by kind permission of the Union Dept. of Agriculture.)

churn, can be washed through the plug hole with the brine and caught in the sieve. Care should always be taken in taking the butter out of the churn not to scrape it against the sides of the churn, as this butter is not easy to remove, and may cause the sides of the churn to become greasy and sticky.

Working the Butter.—When using the roller to consolidate the butter and expel the moisture, great care should be taken not to rub it on the butter worker. The roller is so constructed that, properly manipulated, it will give the requisite pressure to work the butter without any rubbing or friction. No more butter should be placed on the worker than can be conveniently worked.

Do not Overwork.—Too much working is a common fault of farm butter. Such butter has a dull greasy appearance, and its texture is spoiled. Well-worked butter should be just so dry that, when cut and squeezed between the Scotch hands, only a very small number of drops of water appear on the cut surface; and at the same time it should break with a granular fracture, showing the grain quite distinctly, like broken steel. Properly made butter should not contain more than 16 per cent. of moisture.

Do not attempt to work Butter when too soft.—By doing so you will cause the butter to become greasy, and it will be impossible to work the moisture out of it properly. When in too soft a condition to work, the butter should be spread out on a plate, covered with a damp muslin dipped in brine. It should be placed in as cool a place as possible, and exposed to a cross draught between window and door. It is a good practice to stand the plate or receptacle containing the butter in a shallow bath containing water, so that the butter muslin dips into the water and remains constantly wet. After such treatment the butter is usually in a condition firm enough to work. This working should, in the summer, be done either at daybreak or before if possible.

Making up Butter.—For market, the rectangular one pound package is the most suitable. It should be wrapped in good quality wrapping paper $11\frac{1}{2}$ inches long by $8\frac{1}{2}$ inches wide, on which some distinguishing brand is printed. Small wrapping papers are unsatisfactory. As soon as wrapped, the butter should be placed in an ice chest, if ice is available, or in a cool place and covered with wet butter muslin.

Washing up Dairy Utensils.—The churn should be almost free from butter after the brine has been run off. It should be washed with warm water and all traces of butter removed. Give the churn a few turns, ventilating frequently, and let out the warm water. Next scald with boiling water, being very careful to ventilate at every turn of the churn. Run off the boiling water and fix the churn at an angle to allow of free drainage. The rubber band should be removed and all the metal work dried and polished. Leave the lid off and turn the churn upside down to dry. The butter worker, Scotch hands, sieve, etc., should be well scrubbed with a brush, using warm water

after a preliminary washing. The butter muslin should be washed and scalded and hung up to dry. All the utensils should be neatly arranged on the butter worker and the dairy washed down with boiling water and left to dry.

Preserving Butter.—It is extremely difficult in a semi-tropical country to preserve butter made in the summer for winter use unless ice or artificial refrigeration is available. Butter intended for storing should preferably be dry salted, as an excess of salt has always a preservative influence. The butter must be churned and washed most carefully, as the success of these operations has the utmost effect on the keeping qualities of the butter.

The butter is placed on the butter worker and worked just enough to make it into a solid lump. It should then be weighed, and salt in the proportion of half an ounce to three-quarters of an ounce to one pound of butter weighed out. The salt should be divided into two or three portions. The butter should be rolled out and the first portion of salt evenly sprinkled over the butter through a dry hair sieve. The butter is then rolled up and put away for an hour or two until the salt is dissolved. The operation of salting with each of the other portions of salt is done in exactly the same way. When the last portion is added, the butter should be worked fairly dry; it is then ready for "potting" or preserving. Press the butter into a glazed jar, being careful to consolidate it well by pressure so as not to leave any air spaces. When the jar is full, a piece of grease-proof paper is placed over the butter and covered with a good thick layer of good dairy salt. The jar is then tied down with parchment paper, and stored in the coolest place obtainable.

Another successful method of putting down butter is by "pounding" it, wrapping it in muslin instead of butter paper; and storing it in strong brine. A piece of thread fastened longways round the pounds of butter will prevent the wrapping from working loose. A round lid, somewhat smaller than the cask in which the butter is stored, is floated on the brine, and enough weight placed upon it to keep the butter well under.

Summary.—

- (1) To prepare churn, butter worker, and other wooden utensils:—
 - (a) rinse with warm water;
 - (b) scald with boiling water;
 - (c) rub thoroughly with salt;
 - (d) rinse with cold water.
- (2) In warm weather prepare the utensils overnight, and churn before daybreak.
- (3) *Always use a correct dairy thermometer.*
- (4) Use every means at your disposal to get the correct temperature for churning.
- (5) Strain the cream into the churn through a straining cloth.
- (6) Never fill the churn more than half full.

-
- (7) Ventilate frequently.
 - (8) Turn the churn at the speed indicated on the handle.
 - (9) Stop churning when the butter comes, and, taking off the lid, examine the contents of the churn.
 - (10) *Do not overchurn.*
 - (11) Wash the butter twice only.
 - (12) Use brine for salting. This firms up the butter in the churn.
 - (13) Do not put too much butter on the butter worker.
 - (14) *Do not overwork.*
 - (15) Make up the butter neatly into brick-shaped pounds.
 - (16) Use good paper.
 - (17) Keep your butter in a cool place covered with damp cloths.
 - (18) Use a special box for sending your butter to market.

Export of Maize.

By the passing of the Produce Export Ordinance of 1921, and by Government Notice No. 334 of 1st July, 1921, which embodies regulations governing the export of maize, the inspection and grading of the staple crop is placed on a very much more satisfactory footing than has hitherto been the case.

Prior to the passing of the Ordinance a maize grading conference was held in the offices of the Department of Agriculture, at which were present the General Manager of the Farmers' Co-op., Ltd., representatives of the Railways and of all the principal exporting firms, the Secretary, acting for the President, of the Maize Breeders and Growers' Association, and those officials of the Department of Agriculture concerned. At this conference the various provisions now laid down in the regulations governing export were discussed and unanimously agreed upon by all present.

A point of great importance, namely, the need for the grower's identification marks on each bag of grain, was discussed, but it was felt that this was a matter which could be best dealt with through the good sense of the grower and at the discretion of the exporter rather than by Government regulations. Such identification marks are often desirable in order to connect the identity of any particular consignment with the certificate issued in respect of it. In the case of the Farmers' Co-op. grain, this can always be done, since every grower stamps his own special number and the letters "F.C.S." on each bag, and these identity marks are entered on the maize export certificate. Farmers who are not members of the Co-operative Society do not, however, usually mark their bags in any such way, and when graded the bags are merely stamped with the official grade mark. In such cases there is no means of connecting the certificate with the particular consignment of maize for which it is issued, and in several cases last season this proved a very serious disadvantage. Inability to identify the certificate with any special parcel of grain frequently gives rise to doubt in the event of dispute, and all growers who are not members of the Farmers' Co-op. are strongly recommended to mark their grain sacks with their cattle brand or in some other clear manner.

Under the regulations now brought into force, no maize or maize meal may be exported from Southern Rhodesia without having first been inspected and passed by Government Grain Inspectors. For this service a charge of one halfpenny per bag for every bag graded or re-graded will be made. This fee is the same as that in the Union of South Africa, where a charge of a halfpenny per bag is made for port grading and a penny per bag for up-country grading.

In paragraphs 2 and 3 of the regulations it is laid down that maize for export must be contained in new $2\frac{1}{2}$ lb. bags, and that these must be of the quality known either as "A" quality 8 x 8 twill, or "B" quality 8 x 6 bags.

No maize will be graded and passed for export or accepted by the Railways for export unless contained in new bags of one or other of these qualities.

It is interesting to learn that Mr. Humphreys, Chief Maize Grader at Beira, who has just returned from a holiday visit to Europe, where he interviewed the Corn Trade Associations in several centres and also a number of leading buyers and manufacturers of maize products, that the chief causes of complaint in regard to Rhodesian maize are condition of bags and loss of weight due not only to frequent and rough handling, but also to bad sewing and inferior sacks. The seriousness of these defects was strongly emphasised and the need of improvement insisted upon. On the other hand, the high quality of our maize is becoming recognised, and our efforts to maintain the standard appreciated.

Another point strongly recommended by Mr. Humphreys as the result of his enquiries is the advantage of shipping in bulk instead of in bags.

As regards the actual inspection and grading of the grain, this has now been placed on a more satisfactory footing in Rhodesia by the appointment of two additional permanent Inspectors, who will be assisted by one temporary Inspector.

A further innovation is the receipt for the grade certificate. This is a receipt form which the Inspector, after he has filled it in and it has been signed by the recipient, exchanges with the owner of the grain for the grade certificate.

Grading on the farm will, as was the case last year, be carried out whenever possible by Inspectors at the special request of farmers. In such cases the farmer is required to supply transport to take the Inspector to and from the farm to the point where he is working on the railway. Farm grading can only be carried out when other more pressing calls on the Inspector's time permit of such journeys to adjacent farms.

The following is the full text of the regulations governing the export of maize and maize meal:—

GOVERNMENT NOTICE

No. 234.]

[1st July, 1921.]

IT is hereby notified that His Honour the Administrator has been pleased to declare that maize and maize meal shall be produce for the purposes of the "Produce Export Ordinance, 1921," and to approve of the following regulations, framed under the powers conferred by the Ordinance aforesaid, for the inspection and grading thereof.

1. The standard grades for Rhodesian White Flat Maize shall be as follows:—

- (a) R.F.W.I.—Rhodesian Flat White I. Shall be sound, dry, plump, and well cleaned, with a maximum of altogether 1 per cent. of yellow, discoloured or defective grain.
- (b) R.F.W.II.—Rhodesian Flat White II. Shall be sound, dry, plump and reasonably cleaned, and shall not contain more than 3 per cent. of defective and 5 per cent. of other coloured grain.
- (c) R.F.W.III.—Rhodesian Flat White III. Shall be sound, dry and reasonably cleaned, and shall not contain more than 8 per cent. of defective grain and 5 per cent. of other coloured grain. Grain may be of irregular size and shape.

2. All maize intended for export shall be contained either in new 2½ lb. 'A' quality 8 x 8 twill bags or new 'B' quality 8 x 6 bags. The gross weight of a bag of maize for export shall be not less than 203 lbs.

3. All bags shall be properly sewn at the mouth, and shall be provided with two lugs, one at each corner of the mouth. Five ply double twine of good quality shall be used for sewing the bags, and stitches shall not be more than 1½ inches apart.

4. All maize graded and passed for export shall have branded upon the bag the letters R.F.W., in addition to the numerals I., II. or III., which indicate the actual grade assigned to each particular bag.

5. All maize meal for export shall be sufficiently finely ground to pass through a sieve having 18 meshes to the inch. The meal shall be sweet, sound, of good colour and free from mustiness.

6. Bags containing maize meal for export shall be sound and strong, though not necessarily new. The twine used shall be similar to that required for maize. The stitches shall be not more than one inch apart, and the lugs also shall be sewn.

7. Bags of maize meal examined and passed for export shall be stamped with the letters R.M.M. (Rhodesian Maize Meal) by the Inspector.

8. Maize and maize meal shall be graded at such places as shall be approved by the Controller.

9. A uniform grading fee of ½d. per bag shall be charged for all maize or maize meal graded or re-graded, except as provided for in section 9 of the Ordinance.

10. For the purpose of examination of all maize and maize meal an Inspector shall be entitled to abstract and remove samples of grain or meal which shall thereafter be at the sole disposal of the Government through the Controller.

11. Certificates of grade shall be issued by the Inspector to the owner in respect of all maize and maize meal inspected and graded. These certificates shall be in the form set out in Schedules "A" and "B" of these regulations.

12. Grade certificates in respect of any graded maize or maize meal which is considered by an Inspector to have deteriorated in quality below the grade shown on the bag shall be liable to cancellation at the discretion of the Controller.

13. The Inspector shall, on delivery of each certificate to the owner, receive from the owner a receipt therefor in the form shown in Schedule "C" of these regulations. The grading fees shall be due by the owner as from date of the certificate, and shall be paid to the Director of Agriculture or to any Civil Commissioner.

14. Appeals against the decision of or action taken by an Inspector shall be lodged with the Controller within a period of one month from the date of such decision or action.

SCHEDULE "A."

Maize Export Certificate.

I hereby certify that the maize described hereunder has been duly examined by me and found to be in a sound condition, free of weevils, dry, and equal to the standard herein set forth.

Consigned from.....to Beira for shipment.

Consignor.....per B. & M. & R. Railways.

Number of bags.....

Year of harvest.....19.....

Distinguishing marks on bags.....

Class.....

Grade marks (shown on bags).....

Remarks

This certificate is issued by the Government of Southern Rhodesia without involving any responsibility whatsoever on the part of that Government, and is liable to cancellation at the discretion of the Controller.

.....
Grain Inspector.

Date.....19.....

Consigned per S.S.....from Beira to

.....
District Traffic Superintendent,
B. & M. & R. Railways.

Beira.....19.....

SCHEDULE "B."

Maize Meal Export Certificate.

I hereby certify that the maize meal described hereunder has been duly examined by me and found to be in a sound condition, sweet, of good colour and free from mustiness.

Consigned from.....to.....
 Consignor.....per B. & M. & R. Railways.
 Number of bags.....
 Condition of bags.....
 Distinguishing marks on bags.....
 Class.....
 Grade marks (shown on bags).....
 Remarks

This certificate is issued by the Government of Southern Rhodesia without involving any responsibility whatsoever on the part of that Government, and is liable to cancellation at the discretion of the Controller.

.....
 Grain Inspector.

Date.....19.....

Consigned per S.S.....from Beira to

.....
 District Traffic Superintendent,
 B. & M. & R. Railways.

Beira.....19.....

SCHEDULE "C."

Receipt for Grade Certificate.

I hereby acknowledge receipt of grade certificate No.....
 for.....bags of maize/maize meal, dated.....
 19....., for which the fee due at the rate of $\frac{1}{2}$ d. per bag is £ : :

.....
 (Signature of owner.)

.....19.....
 (Date signed by owner.)

.....
 (Initials of Inspector.)



Early ploughing achieved by stooking the maize and ploughing in between the rows of stooks. Gwebi experiment farm.



Visit of farmers to Gwebi experiment farm, 21st March, 1921.

The Advantage of Autumn and Early Winter Ploughing.

By C. MAINWARING, Agriculturist.

Many farmers do not sufficiently realise the advantage of autumn or early winter ploughing. Ample evidence that this is so is afforded by the fact that old cultivated lands, and very often new veld, are not broken up until immediately before the maize crop is sown in November or even December.

The first operation of breaking up the land is most important, and if done at the proper time, it is in no way a difficult problem. There are many advantages attached to early and thorough ploughing, some of them being direct and others indirect, but all are quite important in relation to the final result. The first direct advantage is the exposure of the soil for three or four months to the sweetening influences of sun, air and frost, and the second the increased capacity of the soil for the absorption and retention of moisture.

The practice of leaving old maize lands or new veld until the summer rains is a wrong one. It is common to hear farmers asking each other, "How are you getting on with your planting?" and the reply is generally that the ground is too hard and dry for ploughing, or that the oxen are too thin and weak for the work. February, March and April is the time of year when the work can be done most economically, for the weather is cool, the oxen are in good condition, and the ground is generally in the best order. The first ploughing of new land should be at least eight to ten inches deep if the sub-soil will permit, in order to insure that when the seed is planted it will have a good depth of worked soil beneath it. The practice of many farmers of ploughing only four inches deep, and then putting the seed on the hard bottom, is the reason for many of the low yields that compare so unfavourably with those obtained where better methods have been employed.

Whilst it is obviously impossible to lay down a hard and fast rule as to the date by which ploughing should be completed, farmers would be well advised to spare no effort to break up new land when required by the end of March; then let the land lie fallow for five months, and cross plough again before planting. As stated above, one of the greatest advantages of early and good ploughing is the absorption and retention of moisture. The result of this treatment for new lands is that the soil is in good condition when planting time arrives. There is no question that a more comprehensive system of autumn or early winter ploughing would result in large and better crops, and furthermore a saving of labour would be effected. The nature of our climate is such that on any but moist sandy vleis it is frequently

impossible to plough land to an adequate depth after mid-winter and until the general rains of the coming season. This unduly delays tillage operations; it is, therefore, important that as much ploughing as possible be performed at the proper time when the land is still moist and in a suitable condition for the operation.

It is essential for a successful crop that the soil should be in good tilth, fine, deep, clean and not dry at planting time. The reserve of moisture has an important influence on the fertilisers which may be used. Soil moisture is essential for the best results from fertilisers. If the soil is dry at the time of ploughing, the young plant derives no advantage at the start. It is true that wet weather at a later stage will render the fertilisers soluble and the crop will benefit to a large extent then, but one of the greatest advantages of these manures is the vigorous start they may give when first the seed puts forth leaves and roots. This is lost if the land is dry at seeding time. Ensure moisture by early ploughing, if fertilisers are to be used with confidence as to the results.

It is often stated that the ploughing of old maize lands is delayed as late as possible on account of the winter feed they afford. Better and more valuable winter food can, however, be secured by cutting and stooking the maize when the grain on the ears is dented or glazed, but before the leaves of the plant are brittle and quite dry. The stooks should be built in straight lines through the lands, allowing a space of 30 yards between the rows. By this method the farmer is able to commence ploughing between the stooks while the soil is still moist. The ground upon which the stooks are built can be ploughed immediately the picking or husking of the ears is completed, the stalks being carted away and stacked alongside the kraals to be fed to the cattle at night.

No object is served by leaving the land unploughed until the commencement of the new season, and accordingly it should be broken up without delay. If this is done, the roots and weeds on the lands will be decomposed and converted into available plant food by the time the new crop is sown. This means adding humus to the soil and a saving of manure. The presence of humus in the soil improves its texture, lightening and loosening it, and preventing the compaction of the surface, so that it is of special value in the preparation of maize soils. The humus in the soil is the ingredient which is most subject to alteration and destruction, and under dry conditions it is more or less rapidly destroyed. As soon as it has lost its moisture and become dry, it is rapidly burnt out by the combined action of sun and air. If early ploughing was more generally practised it would unquestionably reduce the prevalence of insects, particularly cut-worm and stalk-borer, because early ploughing buries the vegetable material in which these pests live during the winter. The soil being so prepared is in good condition at planting time, the young plants get a good start, are able to make quick, vigorous growth, and so are soon beyond the stage at which they are most easily injured. Whether ploughing is done well or badly, it is a slow business. It is, therefore, important that when it is done it should be done well and at the proper time.

Southern Rhodesia.

REPORT OF THE DIRECTOR OF AGRICULTURE FOR THE YEAR 1920.

Presented to the Legislative Council.

The remarkable increases recorded alike in agricultural production, in the numbers of live stock and of farmers are most satisfactory, and furnish a reliable indication of the rapid progress that is being made.

The Seasons.—The rains commenced early, but they were somewhat intermittent at first, causing fears in some localities for the maize crop; these happily were ultimately unjustified, but it was necessary to replant a good deal of tobacco. The growing season proved most favourable, the rainfall being well distributed and somewhat above normal. Abundant crops were reaped, and there was ample grass for live stock, which in consequence maintained condition throughout the winter, which was by no means severe.

Owing to late rains, the tips of the maize cobs were much damaged by fungus, and this somewhat affected the appearance of the grain in the bag. However, by the same influence the growth of winter cereals on damp vleis was stimulated. Grass fires caused damage in certain parts of the Territory, but the evil has not been so much in evidence as last year. Notices in English, Dutch and native languages were posted up throughout the Territory drawing attention to the laws relating to this matter; farmers are realising that the remedy is largely in their own hands, and are making organised efforts to combat the danger.

At the end of the year the rains for the planting season were abnormally late and very patchy in incidence, so much so that the coming season cannot be expected to produce heavy crops. None the less, there should be an enlarged area under cultivation, with probably a relative expansion of crops other than maize, an end very desirable for the maintenance of the fertility of our farms and for the safety and profit which a greater diversity of crops must afford.

Cattle.—At a low estimate the cattle of Southern Rhodesia to-day may be valued at £10,000,000, and number 1,500,000 head, of which the larger portion belong to Europeans, and are to a greater or less extent of improved breeding. The grading up of our herds is going on at an increasing rate, although the need of pure-bred bulls is still far beyond the supply, and constitutes one of the most pressing requirements of the country. The year under report was very favourable.

to cattle, and prices have been maintained, owing to the demand both for breeding stock and for draught animals by new comers opening up farms, as well as by established farmers who are extending their operations.

Since the inception of the cattle export trade to the Rand markets in 1916, over 100,000 head have been sent there, representing a value of upwards of £1,000,000. The figures of the export of cattle for the past three years are as shown below:—

Export of Cattle	1918	1919	1920
To the Union of South Africa	12,153	27,520	30,284
To Portuguese East Africa	1,378	1,990	1,998
To East Africa	9,388	...	...
To Belgian Congo	50	...	...
	22,969	29,510	32,282

Of the above, during the year 1920, 7,462 head were breeding stock for the Union and 936 head were breeding stock sent to Portuguese East Africa.

The attitude of Northern Rhodesia continues to prevent access to the markets of the Congo or importation into our sister state, and that although facilities have been granted to cattle from Bechuanaland to enter and traverse on foot a large portion of Northern Rhodesia, a privilege which neither the Union nor this Territory on veterinary grounds allows.

In connection with the export of cattle to the south, some advance was made in so far that it is now permissible to send cattle to Randfontein, Pretoria and Germiston in addition to Johannesburg, and that from the two last-named markets our slaughter stock may now, if desired, be re-consigned to these other two centres, thereby removing limitations which were regarded as adversely affecting the prices realised. To-day the imposition of any quarantine regulations on grounds of health on either slaughter or breeding stock going to the Union from Southern Rhodesia is really unnecessary. The restrictions on the importation of cattle into Rhodesia from the Union have been largely abolished. The opinion is now held in this country that the time is approaching when free interchange of cattle may be allowed, the local quarantine prohibitions which prevent spread of any outbreaks within either country being sufficient to obviate any danger to other states.

The cattle markets of Bulawayo and Salisbury have now reached important dimensions, the former chiefly for slaughter stock for the Union, and the latter mainly for breeding and draught cattle. Gwelo, after a hiatus owing to quarantine, is once more an active centre. Regular cattle sales at rural centres, under the auspices of farmers' associations, which in the previous year proved so successful at Plumtree and Sinoia, have also been commenced at Shangani, Marandellas and Rusape, and this system, now that it has been shown to be beneficial and practicable, is likely to be followed elsewhere.

The cattle industry of Southern Rhodesia is rapidly approaching that critical stage when local markets are no longer sufficient for the increasing surplus. The numbers and quality of the stock available have not hitherto rendered feasible a regular oversea export trade, but an outlet is becoming urgently necessary, and the rapid improvement in quality now generally discernible is bringing very near the time when such export will be profitable. This problem has been receiving the attention of the Cattle Owners' Association and other public bodies concerned. A representative committee has been appointed to collect and publish the fullest possible information with regard to the present position and immediate prospects, with a view to preliminary steps being taken to establish the export of meat on a commercial basis.

The importations of stud stock are always a matter of interest deserving of attention. The importations from the United Kingdom for the four years are as follows:—

1917	...	...	99 bulls	100 females	199 total
1918	...	...	47 "	108 "	155 "
1919	...	...	52 "	86 "	138 "
1920	...	...	54 "	42 "	96 "

Higher prices, difficulty of importation, owing to the exclusion of cattle for Rhodesia on ships carrying cattle for the Union, and high freights, are contributing to arrest importation from overseas. Happily to some extent the demand can be met from our increasing local stud herds, whilst importations from the Union are on a considerable scale, as shown below:—

1917	...	...	239 bulls	2527 females	2766 total
1918	...	...	286 "	579 "	865 "
1919	...	...	493 "	158 "	651 "
1920	...	...	443 "	420 "	863 "

The position occupied by the dairy industry is hardly adequately appreciated. The Dairy Expert reports in this connection as follows:—
“The total value of the dairy products in Southern Rhodesia in 1920 according to available figures is:—

Butter and cheese	...	£99,295
Milk	...	103,861
		£203,156

The amount of farm butter produced for sale in 1920 was less than that produced in 1919. This is a movement in the right direction, as we have now reached the export stage. The more creamery butter made the more stable the price and the better the quality of the butter.”

The progress of the dairy industry is indicated by the following figures:—

Production	1920	1919
	Pounds	Pounds
Creamery butter	381,000	161,000
Farm Butter	219,862	294,784
Cheese	79,202	44,076

Sheep.—Merino sheep are reported to be doing remarkably well now on the Somabula flats, and extension may be looked for in this direction. On our eastern border, where they have long been kept on farms possessing short and suitable grass, they continue, but cannot be said to thrive well, increasing but slowly. In small flocks, cross-bred sheep are found all over the country, and are in demand for mutton for home use and for sale, prices being very remunerative.

Pigs.—The pig market has maintained a high level, and supplies are required for two bacon factories now in active operation. A surplus is now available for export, the total output being approximately worth £50,000 per annum.

Poultry.—The interest aroused by the work of the Poultry Expert is resulting in very material development in that industry. The instruction given by lectures, demonstrations and personal visits is having a marked effect on the production of eggs and poultry, estimated at about 65 per cent. increase over the previous year, as well as in the better sanitation of poultry houses and runs, vigour, condition and productivity of birds and the decreased death rate. There is a great diminution in egg importation, although in certain seasons this must always occur until cold storage facilities are developed. A great extension of poultry keeping is observable both on farms and as an auxiliary source of income by townsmen and railway and mine employees.

Theft, vermin and the spread of infection by present methods of traffic in poultry are the chief sources of loss to the poultry industry, which otherwise finds in Rhodesia exceptionally favourable natural and economic conditions.

An egg-laying test was inaugurated as an incentive to poultry keepers to breed a better class of bird, to prove by practical demonstration what it is possible to achieve with the fowls of Rhodesia, and as a practical demonstration of the right methods of housing, feeding and general treatment. The test, which was the first one held in Rhodesia, has been eminently successful; the number of eggs laid has been excellent, exceeding the highest expectations, and surpassing those of tests concurrently run in the Union, and comparing favourably with similar trials held oversea. The test was conducted at the agricultural laboratories, Salisbury, and the pens and arrangements were a model for the purpose, and also for demonstration to the very numerous visitors who inspected them. The results have been closely followed by the public, and reports issued weekly through the Press have afforded great assistance in this connection.

Crops.—The year under report is remarkable for the happy combination of larger acreages with heavier returns, and the bounteous harvests have done much to establish many struggling farmers on a sound footing for the future. With falling prices for our chief staple, the high cost of implements, sacks, fertilisers and freight by land and sea are against the farmer, and reduction in these directions is very desirable if production is to continue to expand. The position is best indicated by the following statistics collected from returns furnished by the individual growers:—

CULTIVATED CROPS IN ORDER OF AREA IN 1919-20.

Crops.	1919-20		1918-19	
	Acres.	Acre Yield.	Acres.	Acre Yield.
Maize (grain)	173,467	6.45 bags	173,313	5.13 bags
Tobacco	7,504	390 lbs.	3,197	350 lbs.
Wheat	5,139	3.33 bags	4,894	3 bags
Maize (silage)	4,955	3.17 tons	5,619	2.3 tons
Ground nuts	2,430	6.8 bags	1,706	6.2 bags
Sunflower	1,826	6.7 bags	...	...
Potatoes	1,823	23.4 bags	1,601	21.7 bags
Pumpkins	1,801	5.4 tons	2,325	1.9 tons
Beans	1,789	2.04 bags	2,155	1.4 bags
Cattle melons	1,698	5.7 tons	1,895	2.6 tons
Oats	1,402	...	1,485	...
Sweet potatoes	1,115	9.2 bags	...	...
Napier fodder	1,012	...	972	...
Teff grass	968	...	1,120	...
All other crops	4,155	...	9,647	...
	211,094		210,492	

These figures, whilst revealing the preponderating importance of maize and the high place taken by tobacco, will also occasion surprise in showing that next to these in acreage stands wheat, till recently a very inconspicuous crop. It has advanced rapidly owing to the establishment of mills capable of grinding flour and on account of the increased attention being given to irrigation and to our damp vleis for winter use. Next in order stand two oil crops, ground nuts and sunflower, which can be produced in very much larger quantities if local markets are created, which is likely to be the case ere long. Potatoes too could be increased almost without limit if the manufacture of starch or industrial alcohol were shown to be profitable.

It is to be regretted that the average farmer still grows but a small variety of crops, rarely as many as five, although three times that number have been proved to be generally suitable to most farms.

The above statement of the principal crops indicates the extent to which they are grown, and shows in every instance a higher return per acre than was the case last year. The increased acreage, though not great, is also distributed over each item, whilst under the last heading are included sunflowers, 1,826 acres, averaging 6.7 bags per acre; sweet potatoes, 1,115 acres, and 9.2 bags per acre, besides 711 acres of experimental cotton, 581 acres of velvet beans and 278 acres of barley. All the returns were the highest for the past three years, and in most cases for the last five years, so that it may certainly be regarded as a year of plenty.

Maize is the predominant crop, but it is satisfactory to note the continued relative increase in other crops, as shown by the fact that

the area under these was 17.8 per cent. of the total cultivated acreage, as against 15.6 per cent. in the previous year. The season in regard to crops generally was the best yet recorded, and future seasons can hardly be expected to surpass it as a whole, although for individual crops better conditions may occur.

With regard to maize and other crops, the following remarks from a report by the Chief Agriculturist may be quoted:—"The favourable seasonal conditions have nowhere better been reflected than in the maize production of the country, which, as shown by statistics, was in round figures about 1,120,000 bags. This represents an increase of approximately 240,000 bags over the 1918-19 crop, and is nearly 200,000 bags better than the previous record crop of the year 1916-17. Similarly, the average acre yield showed a marked increase, rising from 5.13 bags per acre last season to 6.45 bags per acre this season. This latter yield is virtually one bag per acre better than our previous best of 5.47 bags per acre in 1914-15. It would be cause for great satisfaction if this increase in production and in yield could be attributed to better farming practice. While the use of carefully selected pedigree seed has undoubtedly been a contributory factor, it is doubtful whether the chief credit must not be given to the exceptionally favourable season.

"Crop rotation and the conservation of farmyard manure are not yet receiving the attention which is necessary if the fertility of our soils is to be maintained. One reason for this seems to be a want of appreciation of the fact that nowhere in general farm practice can soil fertility be preserved as long as the greater part of the crops raised on the farm are sold off it. Cotton, wheat, oats, barley and certain fibre and oil crops would certainly, if they could be grown extensively, afford a change of crop, but this alone is not sufficient. The growing of legumes on a more extensive scale, as compared with the acreage planted to maize on arable farms, is an essential to lasting prosperity, and in all parts of the world these crops are primarily regarded as soil renovators, and are grown not for sale, but for home feeding and for conversion into meat, milk and manure. Until Rhodesian farmers appreciate this fact and minimise their risks by keeping live stock to which legumes, straw and root crops can be profitably fed, the arable farming of the Territory cannot be regarded as other than a speculative gamble. As wide if not wider and equally valuable a range of feed crops can be easily grown in this Territory as in any other one can name, yet in spite of its proved merits as a cattle country, the majority of farmers are still looking to maize and other crops which they can sell directly, rather than to those which must be fed to live stock before profits can be realised."

Maize.—The area under maize actually showed only a slight increase in extent over the preceding season, but the yield for the first time in our history exceeded one million bags, being actually 1,120,548 bags, equivalent to 3,921,918 bushels or 22.57 bushels per acre. This constitutes a record, both as regards the total yield and the yield per acre.

The bulk of this crop was grown in the following districts, placed in order of production:—Mazoe, 557,254 bags; Salisbury, 197,372 bags;

Lomagundi, 99,423 bags; Hartley, 68,711 bags; Gwelo, 45,502 bags; these few districts together being responsible for 86.4 per cent. of the total maize yield. The return for the maize belt proper is at the rate of just over 8 bags or 28 bushels per acre.

Early in the season the price exceeded £1 a bag at sidings, and much was sold at high figures. In remote districts maize was bartered at as low as three shillings per bag, but could not be exported at a profit, owing to the prohibitive rates of wagon transport.

Owing to late rains the sample was scarcely up to that of last year in quality, and suffered damage from rain and exposure of grain awaiting conveyance by rail to store or to ship. Export was delayed, and latterly prices were disappointing as compared to those ruling earlier in the season.

The maize exhibited at the Salisbury Show formed the largest exhibition of the kind ever seen in Africa, whilst the quality was such that some of the same entries when sent to the Witwatersrand Show in September carried off practically all prizes open to them. The unexcelled quality of Rhodesian maize is also shown by the growing demand in the Union for meal ground in this country, whilst our mills are manufacturing a variety of products for local consumption and export.

Maize Elevators.—The report on maize elevators, prepared after minute local enquiries by Mr. Littlejohn Philip, was received by Government, but no action thereon has as yet been taken, in view of existing financial stringency, industrial uncertainty and pending developments at the ports in the Union. Beneficial as it undoubtedly would be to protect our maize against weevil and weather, yet the matter obviously hinges upon the question of port facilities, and until bulk storage is provided at Beira with facilities for rapid unloading of trucks and direct loading into ships, there can be no construction of elevators up country; meanwhile we have the annually recurrent emergency measures for handling grain before the advent of the rains, due to lack of storage facilities at each end as well as of haulage. Elevators are very desirable for a grain export trade, but not for meal, which is being increasingly produced and exported, whilst the conversion of much of our maize into beef and bacon may largely discount the need of the elevator.

Grading.—The grading of this year's unprecedented crop presented exceptional difficulties, mainly attributable to casually employed graders—untrained, untried and inexperienced—whose performance of their duties gave some justifiable dissatisfaction to the growers and exporters, as well as to the experts in charge of the work. Half the entire crop was graded not only for export overseas as intended, but also for the south, dealers trading on the basis of the graders' certificates. Owing to fungoid attack and the nature of the season, the grain was more difficult perhaps to grade than last year, and complaints are apt to be lodged in the face of falling markets more than under reversed circumstances. It is recognised that to meet the growing requirements of the trade, there is need, first, of adequate legislative powers to deal with the subject, and secondly, of a competent and reliable staff of skilled graders. The experience of the year has emphasised and confirmed these views.

Barley.—Past experience has shown that a fair sample of six-row or Cape barley can be grown in winter in this country, and as a strong demand has arisen for this grain for malting purposes in South Africa, a representative of one of the leading buyers visited certain districts and stimulated interest in the production of barley. He was guided by officers of the Department of Agriculture, and the Railways have accorded special rates for the conveyance of seed required in the first instance and for grain to be produced. Ultimately it is hoped to establish extensive maltings in the country.

Wheat.—Wheat too, as the foregoing statistical figures show, is receiving more attention each year, and active propaganda to encourage this development has been conducted, with most encouraging results. Natives in the districts of Makoni and Melsetter are beginning to grow wheat increasingly.

Tobacco.—Remarkable progress has been made in connection with the growing, curing and handling of tobacco, for which in large measure the efforts of the Tobacco Expert are undoubtedly responsible. In addition to advisory work to planters, this officer has acted in a consulting capacity to the Rhodesia Tobacco Co-operative Society, and has on the pressing representations of that body and of the buyers recently undertaken provisionally the duty of supervising the actual operations in the Warehouse, with a view to securing improvements in the grading and handling of tobacco. This will satisfy purchasers, and result in better prices for growers.

The area under tobacco has increased from 1,310 acres in 1916 to 7,504 acres in 1920, and the crop is nearly five times what it was. The expansion during the past three years is indicated in the following illuminating figures:—

	1917-18	1918-19	1919-20
Virginian Tobacco—			
Area planted	2,434 acres	3,198 acres	5,546 acres
Total yield	415,210 lbs.	1,179,932 lbs.	2,415,607 lbs.
Average yield	171 lbs.	369 lbs.	435 lbs.
Turkish Tobacco—			
Area planted	813 acres	999 acres	1,958 acres
Total yield	204,961 lbs.	287,680 lbs.	511,633 lbs.
Average yield	252 lbs.	288 lbs.	261 lbs.

In regard to the crop harvested last year, however, the Tobacco Expert makes the following comments, to which it is well to call attention:—"The quality of the cured product was not in keeping with the increased production. The amount of inferior leaf produced was very large. This was due to several causes. Firstly, many growers increased their acreage in excess of their curing facilities. This resulted in a large percentage of badly cured tobacco. Secondly, many growers did not use sufficient fertiliser per acre, and thereby produced large amounts of very small leaf of poor quality.

"The practice of grading leaf on the farm instead of leaving this to be done in the Warehouse is happily gaining ground, fully one-quarter of the Virginian leaf being so dealt with. It is estimated that to-day one in ten farmers in the country are growers of this crop. The possibility of extending tobacco to a much greater extent than is to-day the case is fully recognised. One cogent argument against it is the difficulty of obtaining competent instructors, for this is a branch of agriculture in which skill acquired by tuition and practical experience is very essential. The difference between desirable and inferior leaf as regards price is very great; the latter, so readily resulting from lack of knowledge, is entirely unprofitable."

Cotton.—As regards cotton, the Tobacco Expert, who is also the adviser in regard to this crop, is hopeful but not over sanguine. Experiments aggregating 711 acres in various parts of the country which have now been going on some time indicate that cotton is only likely to succeed in the lower parts of the country, put by the Expert at not above 3,800 feet above sea level, and is hence limited to the more remote parts of the country, not in most of the present settled areas. Further experiment is, however, warranted, and in this connection recognition should be here made of the valuable help accorded to our efforts to test the cotton possibilities of Southern Rhodesia by the British Cotton Growing Association.

Citrus.—The export of oranges, now established and steadily increasing in volume, adds a not unimportant item to our export list, which bids fair in a few years to be of considerable magnitude. At the stage now reached the difficulties of transport overland and inspection at Capetown are being seriously felt, and as the overseas trade increases greater facilities, probably entailing shipping from Beira, will be called for. So far, the commercial development of this business has been conducted by the British South Africa Company from its own citrus orchards, but a number of other groves are reaching the stage when they must also seek markets overseas. To acquire the latest information on the subject of the export trade and the conveyance of oranges, the Citrus Expert was specially despatched to the United States, and he made enquiries in California and Washington and in England, which it is anticipated will materially assist in the development of this export business on sound lines. The total number of citrus trees in Rhodesia to-day is 179,516, of which 52,825 are oranges in bearing and 93,117 oranges not yet in bearing, and the remainder comprise all other varieties of the citrus family, so that the outlook is very promising.

Crop Experiments.—The scope of crop experiments is a wide one, and the results achieved at the Government stations and on private farms are reported from time to time in the *Agricultural Journal* and the Press, so that it will suffice merely to mention here that interesting results, likely to lead ultimately to important extension of farming operations, have during the year been obtained with many crops, notably with maize, rice, wheat, barley, Sunn hemp, Deccan hemp and cotton, besides a variety of green manuring crops, minor leguminous crops and forage plants. The possibilities of such novelties are continuously being brought to the notice of the sections of the farming

public likely to be interested. The introduction of new crops is a slow process, and farmers, however recently they may have arrived or taken up the calling, are yet ever most conservative in following the beaten track made by others. The line of least resistance is usually taken, and they are generally unwilling to venture on new efforts unless the results can be actually seen by them. It is for this reason that the policy of experimental and demonstrative stations in every district has for so many years consistently been advocated, with, let it be admitted, but slight results, except passive assent to the doctrine. The benefits of an experimental station are clearly shown in the interest taken and results obtained at the only existing agricultural experiment station we have, that at Salisbury, which is a source of instruction to a wide farming area, indicative of what might well be done at other places for the benefit of regions with other conditions of soil, climate and with different possibilities and needs.

The experiment farm at the Gwebi serves a somewhat different purpose, the lessons or indications given at Salisbury being here applied on a field scale before being recommended to general practice. Some 500 acres are under the plough and 15 crops grown on a commercial scale, only about half the land being planted with maize. The crops all form part of a series of experimental investigations, and the yields on measured areas are ascertained in connection with comparisons of fertilisers, cultural methods, varieties and systems of rotation all duly reported and recorded. These operations involve much more detailed care and labour than does ordinary farming, and mere profit is not the chief object; yet the value of produce of the year approximates very nearly to the cost of maintenance, as figures below show, a most unusual result in institutions of this sort, and one which is not to be regarded as desirable:—

1920. Produce sold and issued free	£1,567	Expenditure (unaudited)	£1,773
Produce in hand at 31-12-19	400	Salaries	881
Sale of live stock ...	194		
Grazing and feeding fees	122		
Sundries	59		
Difference in valuation of live stock	85		
By balance	227		
	£2,654		£2,654

An important experiment in the feeding of cattle was carried out and the results duly made public. The feeding of store cattle in pens or courts is now practised on a small scale, and seems likely to become general as a means of converting fodder crops, grown for rotation purposes and not otherwise saleable, into a concentrated valuable and portable commodity, at the same time converting cattle which would otherwise lose flesh in the winter months into prime beef at a time when prices are at the best, veld fed stock being scarce. Indeed, for the production of meat of the highest quality and in large quantity for export

purposes it seems that this artificial fattening in winter is likely to become a general practice amongst arable farmers. The value of these feeding experiments is therefore very considerable both in ascertaining methods and costs and in demonstrating what can be done.

Experiments are in progress with the assistance of farmers in different parts of the country, in connection with problems which can best be studied on the spot, such as the amelioration and cropping of magnesian soils, the utilisation of damp vleis in the granite areas and the cultivation of crops suggested for particular regions. Experiment on private farms, as long experience has shown, is a method somewhat unsatisfactory and meagre in the results.

Chemistry.—Chemical researches are being carried on in several directions as time permits, but the routine work connected with the Fertilisers and Farm Foods Ordinance, veterinary enquiries and advice to farmers necessitating analyses or reports, leaves little leisure for original investigations and the very desirable researches regarding the fertility of soils and the composition of crops, grasses and farm products. The examination of cattle dipping fluids has been reduced by the adoption of a system of training Cattle Inspectors to perform these functions and limiting the duties of the Chemists to the examination only of occasional samples for purposes of control and in special cases. To this end, the Cattle Inspectors are being put through a course of instruction, and when the arrangement is in full operation relief from much routine will result, enabling more valuable work to be performed.

Entomology.—The investigations of the Chief Entomologist were somewhat interfered with by staff changes and through his necessary absence on a visit to England, where he represented Southern Rhodesia at the Imperial Entomological Conference, and to Pretoria to discuss proposals for a South African zoological survey. The life history of a number of insect pests was further studied, and light gained on many points which lead to remedial measures being suggested. This work is necessarily slow, but our knowledge is steadily increasing. The pests of maize, tobacco, beans, cowpeas, cabbage, gourds and citrus trees received more particular attention.

The presence of tsetse fly in Southern Rhodesia renders about 10,000 square miles impossible for occupation by Europeans or natives, and as the present infested areas are less in extent than those known to have been occupied by fly in former times, there is always a possibility of re-invasion to that extent at any rate, and possibly further. The tsetse fly being the carrier of fatal disease of human beings as well as of cattle, renders it of great economic importance; whilst the possibility of reclaiming large tracts in this Territory, and of finding a means of so doing over vast regions of Central Africa, renders investigation of tsetse fly a matter of the first importance. For a number of years past the life history and distribution of tsetse fly have been studied by the Chief Entomologist, who has added considerably to our knowledge on this intricate subject. It is recognised that the problem requires, however, further enquiry throughout Africa, and to this end a scheme has been devised for co-operation in this direction by all the British possessions in this continent, and the work already done in Southern

Rhodesia will form an important link in the chain. During the year attention was devoted to mapping the fly areas and to observations in the field, and steps were taken for the appointment of an Entomologist whose time will mainly be devoted to tsetse fly enquiries, a measure amply justified in the circumstances. Two years ago an experiment was initiated to ascertain whether far-reaching measures for the elimination of game would be justifiable as a practical measure against tsetse fly. This has been carried on during the year, and will have still to be continued for some time before, in the nature of things, any final conclusion can be reached. On this matter the Chief Entomologist reports as follows:—"The result of the operations which have now extended over two dry seasons is apparently a considerable reduction of fly, particularly in those parts whence the game has been most effectively removed. No increase or extension of the fly has taken place in this newly-invaded area. The flies show what is believed to be an indication of hunger, in that practically as many females are attracted to human beings as males, and on the whole the experiment appears very promising. Its continuance for at least one more year has been recommended, as results are not yet sufficiently marked for definite conclusions, and the elimination of the larger mammals is still far from complete."

Continued losses of stock from tsetse-borne disease in the Melssetter district, apparently introduced from the fly-infected regions of Mocim-bique Company territory, demand study of the problem on that side of the country, which it is hoped to arrange shortly.

The inspection of plants, fruits and potatoes imported continues; also of orchards and of nurseries, of which latter there are now 17 registered in the country.

Forestry.—The Forest Officer during his first year has been engaged in acquiring impressions of our silvicultural problems, and has, as a result of his enquiries and extensive travels, furnished a memorandum descriptive of forestal conditions in Southern Rhodesia for the British Empire Forest Conference which met in London. Much interest is being evinced by the public in matters relating to forestry, and steps are being taken to prepare for development according to funds available. The forest nursery at Salisbury has exceeded previous records by issuing 160,000 trees and a quantity of shrubs and seed to a total value of £744 11s. 3d., and the demand is greater than the supply. There is scope for much useful work in this direction.

Irrigation.—The possibilities for irrigation continue to be examined, and during the year the Agricultural and Irrigation Engineers reported favourably on schemes affecting 4,054 acres of irrigable land, bringing the whole amount of such land hitherto ascertained by the Department up to a total of 31,448, of which it is estimated that at present only about 4,000 acres are actually under irrigation. In this country, owing to the great possibilities of cultivation under rainfall alone and the expenditure involved in carrying out irrigation schemes, it can hardly be expected that in our present young state the fullest use should be made of irrigation as if this were an arid land; but undoubtedly there is great scope for profitable expansion of this

type of farming, especially in connection with oranges, tobacco, cotton and wheat, and on many farms on a small area for green fodder crops for stud stock and for dairying in winter. Undoubtedly as settlement proceeds, and fuller use of our soil is made, irrigation must increase, and there is much advantage in knowing beforehand the potentialities of our different river systems in this respect. In this connection, an event of importance was the completion of the Mazoe Dam, with the consequent possibility of irrigating 6,000 acres, of which only 750 acres are as yet so dealt with. The advice of the Irrigation Engineers has been given to various public bodies, in addition to numerous individuals, and several large schemes are under consideration.

Meteorologic and hydrographic investigations have been re-organised during the year, and the improved methods adopted are already bearing fruit. The records are published separately.

Agricultural Industries.—Notable improvements have taken place in connection with the grinding of maize and wheat, and several well-equipped mills are now actively engaged in this business, both for local use and for export trade. Two companies, The Northern Rhodesia Fibre Co. and the Barberton Jute Co., are in the field to purchase fibre, particularly that of *Hibiscus cannabinus*, the Deccan hemp, and one is already in active operation weaving sacks and making mats and rope at Umtali.

The oil factory at Salisbury is re-starting, and there are proposals on foot to extract oil from maize as well as to prepare cattle cake and meal from the by-products of the maize-milling industry.

A cotton ginnery has been erected, and has dealt with the entire crop grown last year, preparing bales of raw cotton for export and seed ready for oil extraction.

In addition to the co-operative butter factory at Gwelo, there are now two creameries in operation at Bulawayo—the Rhodesia Creameries, Ltd., and the Model Creamery—and in Salisbury a new factory is in course of construction by the Salisbury Cold Storage, Ltd.

The production of butter is advancing by leaps and bounds, and the home-made article is likely largely to give way before the superior system of factory production. A number of cheese factories have also lately been started.

A new industry has been started by the creation of the Rhodesian Leather Co., Ltd., which has established a tannery and is preparing hides and skins, both for local use and for export. This enterprise has been received with general approval as likely to be of great benefit to the community at large.

The exploitation of the bat guano deposits found in vast caves in several localities in the Hartley, Lomagundi and Victoria districts may be regarded as to some extent adding to the production of fertilisers.

The timber concessions on unalienated land have utilised very considerable amounts of indigenous timber, and are creating a considerable trade.

Associations.—The number of farmers' associations linked up with the Agricultural Union continue to increase, a testimony to the usefulness of these bodies in the past and an augury for the continued activity of the central organisation, which cannot but be for the public good. The recently formed Cattle Owners' Association of Rhodesia is gaining strength, and promises to be an effective institution for supporting and protecting the interests of stock farmers, and securing the advantages of mutual aid and the discussion of the common concerns of all interested in cattle. This body, which is in friendly relationship to the Agricultural Union, is yet another indication of the tendency of the times to combination, such as is seen in the formation of a maize breeders' association and a poultry association, centralising the activities of seven poultry clubs, besides such undertakings as the farmers' co-operative companies for the sale of tobacco, maize and other produce. Proposals are also on foot for the formation of a wheat and barley growers' association.

A new organisation called into being as a result of new conditions is the Settlers' Board, under Government auspices, with branches all over the country, and having for its particular function advice and help to newcomers to the country in finding farms or securing agricultural employment. Three members of the Department of Agriculture serve on the central body of this Board.

Legislation.—The "Native Cattle Dealers Licensing Ordinance, 1920," which became law during the year, provides for the registration of native cattle buyers under a licence costing £10, and subject to severe penalties, which it is hoped will induce European dealers to make careful enquiries into the antecedents of natives employed by them for this purpose, and put an end to the evils arising from this practice in the past.

The Water Ordinance has been amended so that in future all applications without exception for the use of water are to be referred to a Water Court, which will decide the amount of the grant; further, the principle of priority of grants is adopted. A time limit is fixed for carrying out any necessary works, on the completion of which only does the grant become absolute, and subject to cancellation only if not used for a period of years; finally, in the case of combined schemes, the principle of compulsory participation has been adopted. In this way the water law has been materially strengthened and improved.

An amendment of the law relating to fertilisers and farm foods was placed upon the Statute Book during the last session, dealing with the bat guano now being procured in the country, and making certain minor alterations in the old Ordinance.

An Ordinance intended to protect public monuments from vandalism also became law.

Shows.—The usual agricultural shows were held, where the progress of the country is demonstrated and useful ideas exchanged, as well as social intercourse encouraged between various sections of our widely-scattered rural population. The value of prizes and trophies given for poultry at Bulawayo is greater than that of any other poultry

show in the world. Besides the larger shows at Bulawayo and Salisbury, there are a number of district shows, the value of which is scarcely adequately recognised, but which serve a very useful purpose in indicating the potentialities of the neighbourhood, arousing friendly rivalry and serving as feeders to the more representative shows, thus stimulating laudable ambitions, and bringing out meritorious exhibits which otherwise would be unknown. The thought and preparation incidental to these district shows, the contact of interests, the intercourse and the demonstration provided deserve recognition as a most helpful adjunct to agricultural progress.

A departmental exhibit at the agricultural shows is an accepted feature at these gatherings, and serves to give visual instruction in a great variety of ways, and to demonstrate the different activities of the Government on behalf of the farmers.

Pounds.—The number of pounds has now increased to 45. Three new ones have been established and one abolished in the course of the year. Difficulty is always experienced in finding suitable persons to undertake this useful public function.

Brands.—The number of registered brands increased by 501, and now stands at 7,678, a marked feature being the large number of new brands registered by Europeans. The three-piece system in vogue continues to work satisfactorily.

Lectures.—A short course of lectures on agriculture and allied sciences similar to that originally conducted in 1913 and 1914 was held in Salisbury during August. The lectures were well supported by prospective farmers, both Rhodesian-born and from overseas, including half-a-dozen ladies; the attendances ranged from 30 to 40, and occasionally more. The course was entirely free, and facilities were given enabling persons from a distance to attend.

At Gwelo a two-days' course of meetings was arranged, and the excellent attendance and interest shown demonstrated the keenness of the farmers to make use of such opportunities.

The third day of the Salisbury Show was entirely devoted to lectures and demonstrations, which proved a great attraction, and were well attended by eager audiences.

Apart from the above course of instruction, an important part of the work of the technical experts is to attend meetings of farmers' associations and other bodies. During the year 84 addresses by eight different officers were delivered.

Vermin.—The losses of live stock through lion, leopard, and particularly wild dog, continue to be serious, causing more than half the total losses on many cattle runs, whilst wild pig and baboons are a serious nuisance to maize growers. The system of organised baboon hunts has been continued, with results much the same as in the previous year, as shown below:—

1919—Number of hunts, 26; baboons killed, 1,148; cartridges expended, 2,073.

1920—Number of hunts, 21; baboons killed, 968; cartridges expended, 1,938.

Travelling.—An important function of the technical staff of the Department of Agriculture is that of visiting farms not only to impart information, but also to gain first hand intimate knowledge of the interests, point of view and difficulties of the farmers, and to establish the close and friendly relationship with them which so materially helps them in their work. It is largely through this system that the Department is intimately acquainted with the needs and views of the farmers whom it serves, and that such amicable and mutually useful relationships exist. The number of such visits by thirteen officers of the Department of Agriculture to farmers aggregates for the year 1,427, in addition to which the Poultry Expert visited 852 poultry keepers who were not themselves farmers. Correspondence of an advisory nature is very considerable, and visits of enquiry by farmers occupy much time. To render such work helpful and practical, an intimate knowledge of the country is essential. If the cost of transport is regarded as a serious item of expenditure, as no doubt it is, yet it is to be recollected that without it the advisory services of the experts are largely impossible.

Statistics.—The statistical records collected by the Department have proved a source of much information as to agricultural conditions and progress, and interesting particulars derived therefrom are being constantly published, and are found useful in a great variety of ways. Without these data there would be much uncertainty and guess work, which is now reduced to definite fact.

Rhodesia Agricultural Journal.—The *Agricultural Journal* publishes instructive information for farmers. The number of subscribers has increased during the year, and 1,800 copies are now printed. Though revenue from subscriptions and advertisements has increased, so too has the cost of production. There is a very large demand for reprints in the form of bulletins.

Conferences, etc.—In order to keep abreast of the times and enable our farmers to have the benefit of the latest advances of science, the Department participated during the year in the Imperial Entomological Conference, where our Chief Entomologist represented Rhodesia and took an active part in the deliberations, and in the British Empire Forestry Conference, at which, however, it could not be directly represented. The Chief Entomologist also attended a Zoological Conference in Pretoria. Similarly, several officers officially attended the Witwatersrand Maize and Fat Stock Show in September, and took the opportunity of renewing and increasing their knowledge of agricultural progress in the south, whilst the Citrus Expert was sent to California to acquire information in regard to export and other matters there. A conference of the South Africa Poultry Association, the seventeenth annual gathering and the first ever held in Southern Rhodesia, took place in Bulawayo in November, and, apart from the useful debate, served to stimulate in the Territory an interest in the subject which cannot but be very beneficial to the country.

Departmental.—No material change has occurred in the organisation of the Department of Agriculture, which continues on lines

limited by the funds available rather than on those recognised as desirable in a young country full of possibilities and very dependent upon its own resources. In the conduct of departmental activities, often under rather disheartening and unpropitious conditions as regards resources, forces, accommodation and facilities, I have gratefully to acknowledge the constant sympathetic and willing co-operation of the entire staff.

Experiments in Soil Treatment

IN THE ENTERPRISE DISTRICT, SOUTHERN RHODESIA.

By H. BASIL CHRISTIAN.

During a recent visit to see the results of certain experiments in soil treatment which I am carrying out at Ewanrigg, the opinion was expressed by members of the Department of Agriculture that the results so far achieved would prove interesting and useful to my fellow farmers, and at their request the following notes have been prepared.

The particular experiments referred to are being carried out on a long strip of light red land of about 1,200 acres in extent, lying between the Umwindzi River and another small stream. The soil varies from 20 ft. in depth at the river banks to 50 ft. at the highest point between the two streams, and is remarkably uniform in quality throughout. The native grasses are of very poor quality, quite different to those on the rest of the farm, and are of the same varieties from end to end of the strip. With the exception of a small clump of m'sasa and m'warra trees at the extreme west end, the only trees are the Rhodesian violet trees, which in this district we look upon as indicative of very poor land. The following analysis of the virgin soil made at the Government agricultural laboratories last year proved this:—Soluble in hydrochloric acid. Sample treated with acid (Sp. G. 1.12) and digested for 48 hours on a water bath:—

Lime (CaO)	...	...	0.119 per cent.
Magnesia (MgO)	...	...	0.085 per cent.
Phosphoric oxide	...	...	0.037 per cent.
Potash (K ₂ O)	...	...	0.281 per cent.
Nitrogen	...	...	0.070 per cent.

Soluble in 1 per cent. citric acid solution, 100 grams of soil extracted for one week with 1,000 c.c. of 1 per cent. citric acid solution:—

Phosphoric oxide	...	...	0.0007 per cent.
Potash (K ₂ O)	...	...	0.0156 per cent.

The Agricultural Chemist remarked that the soil was markedly deficient in lime, phosphoric oxide, and nitrogen, but contained a good average supply of potash compared with the best types of Rhodesian red soils.

It may be interesting at this point to quote from a report by the Agricultural Chemist on a sample of soil also taken last year from one of my other lands which has been under cultivation for about twelve years. As virgin land, this soil yielded about $9\frac{1}{2}$ bags of maize per acre, but gradually became worked out and dropped as low as $2\frac{1}{4}$ bags per acre. For the last five years it has gradually been worked up, and last season, after a light dressing of kraal manure and 200 lbs. superphosphate ($16\frac{1}{2}$ per cent.) per acre, yielded just over 15 bags of maize per acre.

Soluble in hydrochloric acid. Sample treated with acid (Sp. G. 1.12) and digested for 48 hours on a water bath:—

Water	4.30 per cent.
Loss on ignition (org. matter and combined water)	10.76 per cent.
Phosphoric oxide	0.085 per cent.
Potash	0.110 per cent.
Nitrogen	0.175 per cent.

Soluble in 1 per cent. citric acid solution, 100 grams of soil extracted for one week with 1,000 c.c. of 1 per cent. citric acid solution:—

Phosphoric oxide	0.0027 per cent.
Potash	0.0181 per cent.

The Agricultural Chemist remarks.—“Comparing the composition of the two soils, it will be seen that the good soil contains 2.5 times more nitrogen, 2.29 times more phosphoric oxide soluble in concentrated hydrochloric acid, 3.85 times more ‘available’ phosphoric oxide, and 1.16 times more ‘available’ potash, whilst the poor soil contains 2.55 times more potash soluble in concentrated hydrochloric acid.”

The light red land, already referred to, was broken up in February, 1918, and laid out accurately in strips 70 yds. wide at right angles to the general slope of the land. A 12-ft. roadway was left unploughed between each two strips for the purpose of checking erosion. In 1919 it was planted to velvet beans, which made such poor growth that they were not worth reaping or ploughing under as a green manure crop.

In 1920 No. 1 strip was again planted to velvet beans in December. After the beans were up, wood ash was spread over the land at the rate of $\frac{3}{4}$ ton (long) per acre, and worked into the soil with cultivators, one acre at the west end of the strip and $\frac{1}{4}$ acre at the east end being kept as controls and receiving no wood ash. No. 2 strip also had $\frac{1}{4}$ acre control without ash at the east end, five acres of this strip being treated with wood ash at the rate of 2.2 tons per acre, and the balance at the rate of 1.1 tons per acre. On No. 2 strip the ash was disced in December. On 17th January the upper 35 yds. for the length of this strip—about 900 yds.—was planted to velvet beans, and the lower 35 yds. to sunn hemp. No. 3 strip was planted to sunn hemp on 18th January, but had no wood ash or other treatment.



Maize after the land had been treated the previous year with one ton
of wood ash per acre and a crop of velvet beans ploughed under.
Ewanrigg farm, Areturus.



Maize after velvet beans ploughed under but no wood ash applied.

On the control plots of strips Nos. 1 and 2, the velvet beans made practically no growth, the plants not even sending out runners. On strip No. 1, the growth of velvet beans was moderate where it had the light dressing of $\frac{3}{4}$ ton per acre of ash. The crop on this strip was ploughed under in April, 1920. On strip No. 2, where a dressing of 1.1 tons of ash per acre was applied, the velvet beans made much better growth than on strip No. 1, and where the dressing of ash was increased to 2.2 tons per acre the growth was quite good, considering the lateness of date in planting. The sunn hemp on strip No. 2 grew to a height of $3\frac{1}{2}$ ft. with the 1.1 ton dressing, and about 9 ft. with the 2.2 ton dressing of ash. The velvet beans on this strip were ploughed under early in May. The sunn hemp was left to ripen its seed, but owing to lateness in planting a very small proportion of the seed matured, so the crop was left to be mowed and burnt in November, 1920. On strip No. 3 the sunn hemp made a growth of about $4\frac{1}{2}$ ft. and the crop was ploughed under with a Stag plough in April, 1920.

All three strips were reploughed in November and December, 1920, by which time there were no signs of any partially decayed vegetation to indicate that green crops had been ploughed under earlier in the year.

The accompanying photos are a fairly good ocular demonstration of the value of wood ash on this particular soil. Photo No. 1 shows the untreated control plot on strip No. 1, which it will be seen will yield nothing. In the distance can be seen the line across the strip where the wood ash dressing at the rate of $\frac{3}{4}$ ton per acre started. Here the mealies are about 6 ft. high and have fair sized cobs. On strip No. 2 with the 1.1 ton dressing the mealies are decidedly better, while photo No. 2 shows the effect of the dressing of 2.2 tons ash per acre. No. 3 strip, which had no ash treatment, but which had a fair crop of sunn hemp ploughed under, has not been appreciably improved in any way. The cobs are small and the stalks short and of a poor colour.

From the above it will be seen that velvet beans by themselves have no effect on this soil. In spite of the control plots having grown two crops of velvet beans in succession, the soil is incapable of growing mealies. A light dressing of $\frac{3}{4}$ ton per acre of wood ash makes a marked difference. A dressing of 1.1 tons ash still further improves the crop, while double this dressing gives a really payable crop (when mealies are at a price that makes them payable at all). These results confirm the results of experiments I have been carrying out during the last five years on this farm.

My experience is as follows:—

(1) On good land unassisted velvet beans either reaped or ploughed under improve the soil slightly. With a dressing of $\frac{3}{4}$ ton of ash per acre applied to the velvet bean crop, the effect on the maize the following year is great, and I can show to-day that this effect lasts for five years at least. With a heavier dressing of ash this effect is even more marked.

(2) On poor lands velvet beans without ash make poor growth and have no effect.

(3) In every case where I have applied the ash *direct* to the maize crop without previous green manuring treatment, although there has been an improvement it is not great, and the effect is not lasting.

(4) Kraal manure on my soil does not have such a *lasting* effect as wood ash in conjunction with velvet beans, although it has a bigger effect on the first crop of maize.

(5) Ground nuts (harvested) without ash, even though treated with a phosphatic fertiliser, have no effect on the succeeding maize crop. With ash the effect is still noticeable four years afterwards.

(6) Though my land is poor in phosphates—superphosphate, bone meal, and phosphatic guano alone on land which has received no previous manurial treatment have no apparent effect either on the maize crop or legumes, but where the land has had a dressing of wood ash, even as far back as 1917, the effect of double superphosphate is most marked to-day. I have applied far more phosphate per acre in the form of 41 per cent. double superphosphate than there is in two tons wood ash per acre without any appreciable results to either maize or legumes.

(7) I have applied agricultural lime, without other manurial treatment, at the rates of $\frac{1}{2}$ ton, 1 ton, $1\frac{1}{2}$ tons and 2 tons per acre, but in no case has it had any apparent beneficial effect on the maize crop.

(8) The fact that a legume has nodules on its roots means very little, unless the soil conditions are favourable to the nitro bacteria. I have so far tried six different legumes on a fairly extensive scale, viz., velvet beans, ground nuts, cow peas, sunn hemp, dhal and the native legume sesbania.

With the exception of velvet beans, none of these has had any improving effect on the soil at Ewanrigg unless the soil has been treated with wood ash, even though—especially in the case of sesbania and sunn hemp—the roots are covered with nodules.

(9) Wood ash in conjunction with a legume is the cheapest method I have tried of getting my land into good heart, if the wood ash can be landed on the farm at a reasonable cost.

(10) I am to-day getting my maximum yields from land that I first treated in this manner and subsequently have given light dressings of kraal manure, supplemented by a dressing of superphosphate, plus careful seed selection. It pays me to devote a portion of my capital to a mob of cheap cattle as machines for turning my veld grass into manure, for which purpose they are kraaled at night all the year round.

I have submitted the above notes—in which the facts can be taken as accurate—to the Agricultural Chemist, who has kindly drawn the following deductions:—

Soil Treatment at Ewanrigg.—Deductions indicated from Mr. Christian's observations upon his experiments on poor red land at Ewanrigg.

Note.—Maize has been the test crop for the various soil treatments referred to in the article.

The soil with which the article deals was a well-drained poor red soil containing very little humus, and the results of chemical analysis indicated that it was markedly deficient in nitrogen, phosphoric oxide and lime, but contained a good average supply of potash compared with the best types of Rhodesian red soils.

The limiting factors in this soil for crop production would therefore appear to be (1) humus and nitrogen, (2) phosphoric oxide, and (3) possibly sourness, due chiefly to the presence of acid mineral compounds.

Deductions from observations.—

- | <i>Treatment.</i> | <i>Deductions.</i> |
|---|---|
| 1. Lime alone. | Sourness was corrected in proportion to the quantity of lime applied, but the subsequent crop return was not influenced noticeably mainly owing (a) to lack of humus with consequent deficiency in nitrogen and poor water holding power, and (b) to lack of available phosphoric oxide.

<i>Limiting factors—humus, nitrogen and phosphoric oxide.</i> |
| 2. Phosphatic manures, viz., superphosphate, bone meal, and phosphatic guano. | The effect of this treatment was not marked, owing mainly to deficiency in humus and nitrogen, and to a lesser extent to sourness, although the degree of sourness in the soil was not sufficient to be regarded as a serious limiting factor.

<i>Limiting factors—humus and nitrogen.</i> |
| 3. Leguminous green manure alone. | If the velvet beans grew well enough to produce a mass of vegetable matter worthy of being considered a green manuring treatment, a reasonable deduction is that the effect of the treatment on subsequent crop returns was not marked, owing mainly to deficiency in phosphoric oxide.

<i>Limiting factor—phosphoric oxide.</i> |
| 4. Wood ash alone. | The effect of this treatment was not great, owing mainly to deficiency of humus and nitrogen. The results were better than phosphatic manure alone, because the sourness was corrected somewhat and the supply of available potash in the soil was increased.

<i>Limiting factors—humus and nitrogen.</i> |

5. Leguminous green manure and wood ash. The effect of this treatment was very marked, owing to the replenishment of the soil in all the important factors limiting the crop return from the soil under experiments, viz., humus and nitrogen, phosphoric oxide, and also in lime, which encourages the growth of beneficial soil organisms.
6. Kraal manure. The effect of this treatment was very marked, but not lasting. The soil was replenished in the limiting factors, humus, nitrogen and phosphoric oxide. The sourness was not corrected, but, as already stated, the degree of sourness in the soil was not a serious limiting factor. When the condition of the soil has been improved by incorporating humus, and the retentive power of the surface soil for water and soluble plant food has been increased, the effect of dressings of kraal manure will probably be more lasting.

Wildfire and Angular-Spot.

By F. D. FROMME, Plant Pathologist.

Virginia Agricultural and Mechanical College and Polytechnic
Institute and the United States Department of Agriculture,
co-operating. Extension Division, Jno. R. Hutcheson,
Director, Blacksburg, Virginia.

[*Note*.—Both of the tobacco diseases described in the following article occur in Rhodesia, and were no doubt introduced through the use of tobacco seed imported from the United States of America. Angular-spot has been very prevalent during the past two seasons, and has caused severe loss to many tobacco growers. The Department of Agriculture is prepared, for this year, to treat tobacco seed free for farmers in Southern Rhodesia. The treatment will be carried out by the Chief Chemist, and the seed will afterwards be tested for germination before being returned for sowing purposes. It is hoped that by using treated seed and by observing the precautions outlined in the article that the percentage of diseased leaf produced next season may be very largely reduced.—H. W. Taylor, B.Agr., Tobacco Expert.]

“Losses from tobacco diseases have been especially severe during the past four seasons. The greater part of these losses has been due to two diseases, wildfire and angular-spot, which attack the leaves, and which are particularly troublesome in wet seasons. In the Virginia Crop Report for September, 1920, the forecast shows a decrease of 21,729,000 pounds of tobacco during the month of August due to damage attributed to the continued wet weather. The greater part of this loss is undoubtedly due to the two diseases mentioned. They are not caused by wet weather, but like many other diseases spread and develop more rapidly during wet seasons.

“These two diseases, although quite similar in their general effect on the tobacco leaf, are distinct and produce different kinds of spots. Farmers as a rule do not distinguish between them, until the differences have been pointed out to them, and they generally call both wildfire, blackfire, or some similar name. The angular-spot is irregular or angular, while the wildfire spot is round and is bordered by a pale green or yellow halo. Angular-spot is not so angular in shape when found on heavy tobacco, but it never has the halo which is characteristic of wildfire. Both spots enlarge rapidly, and the leaf tissue involved is killed, browns and dries up or rots out in wet

weather. Affected leaves are sometimes completely ruined, and although the leaf may still be marketable, there is a considerable loss in weight and grade.

"Although both diseases occur to some extent in all parts of the state, they are especially prevalent in the flue-cured belt. Angular-spot is found to some extent in nearly every field, while wildfire occurs in about one field in five. Angular-spot is usually found rather evenly distributed throughout a field, while wildfire is often restricted to one or more spots in a field.

"*Cause of the diseases.*—Both spots are diseases in the true sense of the word; they are caused by specific bacteria, or germs as they are commonly called, which so far as is known attack tobacco only. The bacterium which causes wildfire is known technically as *Bacterium tabacum*, and that which causes angular-spot as *Bacterium angulatum*.

"Farmers generally have attributed these diseases to wet weather, the fertilizer, or other agencies, but these are only secondary causes. If the bacteria which cause the spots were not present there would be no angular-spot or wildfire no matter what the weather conditions were. It is true, however, that wet weather and other factors are important in determining the amount of injury caused by the two diseases. Of these factors weather is the most important. A promising field of tobacco may become generally infected after a few days of continuous rainfall. This is due to the fact that the bacteria are spread from plant to plant by the splashing and blowing of rain drops, and that moisture favours the entrance of the bacteria into the leaf. They are also spread by insects, especially flea beetles, and by handling the plants in worming, suckering, and topping.

"Fertilisers affect the size of the spots and the severity of the diseases in so far as they modify the growth of the tobacco plants. The most forward or vigorous plants in a field are usually infected more seriously than the slower growing plants. Experiments with fertilisers do not indicate, however, that either disease may be controlled by modification of the fertiliser. The fertiliser applications which tend to produce a good crop will at the same time tend to make the crop more susceptible to the disease.

"*Sources of infection.*—It has been found that both diseases occur on plants in the plant bed, and that the amount of disease which develops in the field is determined in large measure by the amount of disease found in the bed. Cases have been seen where the disease has spread from one field to another, but this has been found true only of fields in close proximity, and there seems to be little danger from this source if the fields are separated by a hundred yards or even less, unless of course they are carried there on the clothes or hands of some person. It may be set down as a rule, with few exceptions, that the presence of either disease in the field indicates its presence in the plant bed.

"A careful inspection is often necessary to show the presence of disease in the bed. This is particularly true of angular-spot, as the spots here are small and rather inconspicuous. They are seen most

easily at about the time of transplanting. The disease becomes established in the field by the setting of diseased plants from the bed. The chances for rapid spread and general infection in the field increase as the percentage of diseased plants set from the bed increases.

"The problem of control centres on the plant bed. If it can be kept free from disease the chances of loss in the field are slight. Once the disease is established in the field there is little or nothing that can be done to check its spread.

"Infection in the seed bed usually comes from one of three sources: the seed, the cover, or the soil. Of these the seed is undoubtedly the most common and important source. Both diseases occur on seed pods as well as on the leaves. If seed were selected from plants entirely free from disease there would be no danger of infection from this source. Unfortunately, the diseases are now so general that it is difficult to find disease free fields, and the selection of disease free seed is therefore possible in only an occasional field. Seed treatment is therefore necessary to insure against introduction of the disease into the bed on the seed.

"Even though the seed be free from disease, infection may be introduced by the cloth cover or the soil. Next to the seed, the cover seems to be of most importance. If an old cover, that has been used on an infected bed the previous year, is employed it is quite probable that some of the disease bacteria will be retained on it and serve as a source of infection for the new crop.

"Although it has not been proved that the bacteria can live over in the soil of the plant bed, it is quite possible that some infection may come from this source. It is highly advisable as a precautionary measure that a new bed be made up each year. Burning the old bed would probably not insure complete freedom from infection.

"*Control of the disease.*—It will be seen from the foregoing discussion that control of angular-spot and wildfire consists of prevention of infection in the plant bed. The three chief preventive measures designed to insure freedom from infection in the bed are:—

1. Use of disease free seed.
2. Use of a clean cover.
3. Use of a new plant bed.

"The second and third measures need little explanation. The cover should be of new cloth, or if old cloth is used it should be boiled in water for a few minutes. A new cover is preferable and the cost is a small item when compared with the value of the crop. The plant bed should be on new ground not subject to drainage from tobacco fields. It should not be near other beds where untreated seed or covers are used.

"Disease free seed may be obtained from fields which are entirely free from either angular-spot or wildfire or by treatment which will destroy the bacteria without injury to the seed. Even though the seed is thought to be free from disease, treatment is desirable as an extra precaution.

"The treatment is as follows: The seed should be soaked for 15 minutes in a solution of formaldehyde. The solution is made by adding one ounce of 40 per cent. formaldehyde to one pint of water. After treatment the seed should be washed thoroughly in water and spread out to dry. The seed may be kept for several months without injury, providing they have been washed and dried thoroughly.

"Formaldehyde may be obtained at most drug stores, and is usually sold in the 40 per cent. strength. It is a liquid which is non-poisonous, but the fumes are irritating to the eyes, nose and throat.

"In treating, the seed may be stirred into the formaldehyde solution in a pail or jar; then strained off through a fine cheese cloth. The seed should be stirred into the solution throughout the 15 minute period.

"The additional precautions which are necessary are mostly self-evident. There are cases on record where farmers have visited their neighbours' plant beds to become familiar with the appearance of the diseases, handled plants there, returned and inspected their own beds, and in this way transmitted the infection. Also cases where farmers have helped each other in setting plants and have transmitted the infection to both crops, although only one bed contained diseased plants."

Review of the Rainfall Season, 1920-21, in Southern Rhodesia.

By C. L. ROBERTSON, B.Sc., A.M.I.C.E., Hydrographic Engineer.

The season 1920-21 was characterised by the failure of the early rains, the late arrival of the general rains, the protracted nature of the rainy season, which did not end before the middle of April, and, lastly, abnormal rains in May. Broadly speaking, the year may be described as one with total fall above the average for all portions of the country on the western side of the main divide and below the average on the eastern side, the deficiency being most marked in the extreme eastern districts. The exceptions are Lomagundi, in which the fall was 1 inch below normal; and Mrewa, Selukwe, Insiza, Umzingwane and southern portion of Bulalima, in which the fall was above normal. The position is shown on the accompanying map. In the area shown shaded the total fall was above the normal, and in the area unshaded it was below normal.

The following table gives a comparison between the mean rainfall recorded in each district during the year and the mean normal fall for the district.

Mashonaland—

	Mean Rainfall, 1920-21.	Normal Mean Rainfall.
Charter	29.55	28.43
Chibi	17.94	22.22
Chilimanzi	26.45	27.62
Darwin	31.15	31.36
Gutu	26.93	28.07
Hartley	36.65	29.93
Inyanga	33.23	37.10
Lomagundi	31.37	32.86
Makoni	29.73	35.47
Mazoe	32.87	34.51
Melsetter	52.92	56.79
Mrewa	38.54	35.43
Mtoko	29.48	33.46
Ndanga	34.12	41.27
Salisbury	34.88	33.32
Umtali	32.74	37.22
Victoria	28.21	30.55

Matabeleland—

Belingwe... ..	20.43	24.12
Bubi	28.83	23.13
Bulalima	30.57	24.05
Bulawayo	28.21	22.59
Gwanda	17.61	19.90
Gwelo	32.66	27.04
Insiza	29.50	23.96
Matobo	25.08	22.60
Sebungwe	39.05	27.12
Selukwe	36.60	33.06
Umzingwane	29.66	25.31
Wankie	26.00	26.07

The mean rainfall over Mashonaland was 32.16 inches, as compared to a mean normal of 33.96 inches. In Matabeleland the mean rainfall was 28.68 inches, as compared to a mean normal of 24.91 inches. The average over the whole country was 30.42 inches, as compared to a mean normal of 29.38 inches. A more detailed examination of the monthly distribution of the rainfall during the year will give a clearer view of the nature of the season.

Early Rains.—The rainfall during October was above the average in all parts of the country. During November the rainfall was negligible, and during December was below the average in all districts, except those along the western border. Up to the end of December the total average fall in Mashonaland was 7.34 inches, as compared with a normal fall of 11.89 inches. In Matabeleland the average fall was 7.82 inches, as compared with a normal fall of 9.39 inches.

General Rains.—There were heavy general rains during the early portion of January, but the latter half of the month was dry. The January fall was below normal in Mashonaland, except in the districts of Hartley, Mrewa and Mtoko. In Matabeleland the January rains were more normal and were above the average in the districts of Bubi, Bulalima, Bulawayo, Gwelo and Insiza. During February the rainfall was above the average in the western portion of Mashonaland and in the whole of Matabeleland, with the exception of Selukwe district. The seasonal total to the end of February was below the average for all districts in Mashonaland, with the exception of Hartley district. In Matabeleland the fall to the end of February was above the average in the districts of Bubi, Bulalima, Bulawayo, Insiza, Nyamandhlovu and Sebungwe. Up to the end of February the average fall over Mashonaland was 22.53 inches, as compared to a normal of 27.55 inches, and over Matabeleland the average fall was 21.07 inches, as compared to a normal of 21.88 inches.

During March and early portion of April heavy rains were general, the fall during both these months being much above normal for all portions of the country. The average fall in Mashonaland during these two months was 8.57 inches, as compared to a normal of 5.73 inches, and in Matabeleland a fall of 7.65 inches, as compared to a normal of 2.64 inches. During the first week in May there were heavy rains in most parts of the country. They were heaviest in the Salisbury district, where the average fall amounted to 2.78 inches. The average over Mashonaland was 1.22 inches, compared to a normal of 0.35 inches in May, and in Matabeleland was 0.82 inches, compared to a normal of 0.25 inches.

Reviews.

THE FRIESLAND HERD BOOK.

We have received a copy of Vol. I. of the "Herd Book of the Friesland Cattle Breeders' Association of South Africa," which is published under the authority of the South African Stud Book Association. This first number of the Association's Herd Book contains a record of all Friesland cattle approved and admitted for registry since the publication of Vol. XII. of the "South African Stud Book" up to 30th June, 1919. The entries number 381 males and 1,208 females (including appendix and foundation sections), and previous registrations will be found in the first twelve volumes of the "South African Stud Book." The publication of a separate herd book marks an era in the history of the Friesland breed in South Africa, and is certainly justified by the popularity of the breed. The head office of the Association is at 115, St. Andrew Street, Bloemfontein, and Mr. James Woodin is Secretary and Inspector.

THE DEVON CATTLE BREEDERS' SOCIETY OF SOUTH AFRICA.

It is pleasing to be able to record that this Society, which was started in March, 1918, with a membership of barely 25, has to-day 105 members. The Society has published two volumes of its herd book, the first of which is a complete record of all registered Devons, whether living or dead, that have ever been in South Africa. The Society has adopted the Canadian method of registration, by which a herd book number is allocated immediately a birth certificate is received with an application for registration. This is a great improvement on the old method, which did not allocate a recognised herd book number until the publication of the herd book. The Society would appear to be established on a sure foundation, and the note of optimism sounded at the recent general meeting in Bulawayo as to the future of the breed is in our opinion justified.

SOUTH AFRICAN SHORTHORN HERD BOOK.

We have to acknowledge the receipt of Vol. II., 1920, of the "South African Shorthorn Herd Book," which contains the pedigrees of C.H.B. and Lincoln Red males and females entered up to 30th June, 1920. The Secretary and Treasurer of the South African Shorthorn Society is Mr. Cuthbert A. Pope, Box 173, Queenstown, Cape Province.

RHODESIAN HOUSEWIFE'S GUIDE.

By Mrs. C. J. McClellan; Argus P. & P. Co., Ltd., 3s.

Mrs. McClellan, who will be known as a successful exhibitor at Bulawayo shows, has produced this little cookery book, which contains in a concise and practical form recipes for the making of jams, jellies, chutney, bread, cakes, puddings and the bottling of fruits, vegetables, etc. The recipes are specially adapted for Rhodesian climatic conditions, are economical and have by experience been proved successful. The book meets a much-felt need, and will be a valuable aid to the housewife in town or in the country.

MESSRS. G. H. WILLIAMS & CO.'S SEED LIST.

This well-known firm of seed merchants at Salisbury have issued their Catalogue and Planters' Guide for the season 1921-1922. The booklet contains a fund of practical advice concerning the sowing and treatment of various garden and field crops, and will be found particularly useful to the novice.

Witwatersrand Agricultural Society.

RAND SPRING SHOW OF FAT STOCK AND MAIZE AND SALE OF PURE-BRED CATTLE, ETC.

The Sixth Annual Spring Show of the Witwatersrand Agricultural Society takes place this year on Monday and Tuesday, the 5th and 6th September next, and will be held at the Society's Show Grounds, Milner Park, Johannesburg.

The programme provided for the forthcoming show has been materially revised and re-cast in sundry directions, and more particularly in the section for slaughter cattle, which is now confined almost entirely to the young animal, *i.e.*, up to $3\frac{1}{2}$ years, and the old animal is entirely eliminated, a policy which the Society feels is the sound one now to adopt, if their Fat Stock Show is to exercise the desired influence on the breeders in the country.

The classes for individual animals, with from one pair of incisors to full mouth, have been retained, with the same ample prize money as before, but in place of the classes hitherto confined to groups of any age, each representing the beef breeds, and in each of which prize money of £20, £10 and £5 was offered, there are now substituted four classes for groups of five animals each of any breed, with ages ranging in the different classes from one pair of permanent incisors to full mouth, and with prize money in each class of £50, £20 and £10.

The effect of this change will, it is hoped, force competition in each of the group classes mentioned between the different breeds, and should, therefore, make for greater interest and educational value than has been the case in former years.

In the class for the best group of veld fed slaughter oxen, the number of animals has been reduced from 50 to 25, with prize money of £50, £20 and £10, instead of one prize of £50, as last year.

In addition to the foregoing, sundry special prizes are also offered in the slaughter classes by breed societies and others, including one of £25 by Henderson's Consolidated Co., Ltd., for the best five oxen under five years, any breed or cross, and a prize of £25, with £15 second and £10 third, by the Aberdeen Angus Cattle Breeders' Society of S.A., for the best three pairs of Aberdeen Angus or grade oxen showing not more than six teeth.

As in previous years, all animals will be judged with a view to their suitability for the export trade, and it is, consequently, a condition of judging that the minimum weight of a carcass for export will be taken to be 600 lbs., and the maximum 825 lbs., and the

factor of 60 per cent. will be regarded as the approximate figure for calculating the portion of carcase to live weight.

In the maize section there are in all 34 classes provided, namely:—

	Classes.
For shelled maize (10 bags and 10 ears) ...	6
For 500 breeding ears	4
For 200 breeding ears	7
For 10 breeding ears	29
For 1 breeding ear	30
For juvenile competition	8
	—
	84

The prize money offered throughout is on the usual generous scale which characterises the Rand Society's shows, and, in addition, championship silver and grand championship gold medals are offered in each of the sections as above.

Three challenge cups will also be offered for competition, namely, the "Sam Mottram" fifty guinea cup for the 500 ears grand championship, the "Kleinenberg" twenty-five guinea cup for the 200 ears grand championship, and a fifty guinea challenge cup, by the Society, for the district winning the most prizes in the maize section, the winner of each of the cups mentioned to receive, annually, the Society's gold medal.

Provision has again been made in the prize list for a juvenile competition, open to lads not over 18 years of age, and for which substantial prize money is offered, including two championship prizes—one of £5 with the Society's silver medal, and the other of £2 10s. with a similar medal.

The Society will also hold their sixth annual sale of breeding stock on the second day of the show period, and, following the practice of last year, entries will again be accepted for pure-bred non-registered bulls and heifers suitable for ranching purposes, in addition to registered pedigree animals. In this section a prize of £20 will be offered for the best bull on the show, any breed, and £10 for the best cow or heifer, the prizes to be awarded only on condition that the animals are sold on the show ground during the show period.

Permits for the removal of cattle from the other Provinces and from Rhodesia to and from the show will be issued by the Union Veterinary Department, Pretoria, on the usual conditions. Cattle from any of the above areas which are sold for immediate slaughter may be railed direct from the show ground to the quarantine section of any approved abattoir in South Africa.

All exhibits for the show will be carried by the railway at full rates on the forward journey, and returned free, if unsold, whilst natives, accompanying live stock will travel at, approximately, third-class fare for the double journey.

It will, no doubt, be noted with satisfaction by exhibitors that all prize money this year will be paid out in full to the successful exhibitors, without restriction or limitation as to the number of entries in any particular class.

Messrs. John Roderick & Co., Bloemfontein, will again conduct the sales of breeding stock, and Mr. W. Bailie, Johannesburg, the slaughter stock.

The entries for the breeding stock sales close on 31st July, and for the fat stock and maize show on 15th August.

Prize lists, in English and Dutch, with entry forms, together with all further particulars, may be had on application to the Secretary of the Society, Box 4344, Johannesburg.

Mexican Marigold.

Dr. I. B. Pole Evans, Chief, Division of Botany, Union Department of Agriculture, in his Annual Report for the year ended 31st March, 1919, refers to certain experiments conducted with a view to the eradication of Mexican marigold (*Tagetes minuta* L.). Four plots of grossly infected land at the Botanical Laboratories were sprayed as follows:—

- (a) Sodium arsenate 4 ozs. to 4 gallons of water.
- (b) Sodium arsenite 1 oz. to 6 gallons of water.
- (c) Copper sulphate 3 lbs. to 13 gallons of water.
- (d) Iron sulphate 2 lbs. to 3 gallons of water.

The two latter treatments were ineffective. Both arsenate and arsenite of soda used in the above strengths were entirely effective in destroying the plants.

The highly poisonous character of arsenate and arsenite of soda renders it necessary to use great care if these poisons are employed for the destruction of Mexican marigold. Under certain circumstances there may be conditions where they could be used with safety, but, generally speaking, it would be advisable to keep all farm stock away from land which had been sprayed with arsenical compounds for several months, and certainly until heavy saturating rains had fallen.

In this connection it may be mentioned that in the issue of the Agricultural Gazette of New South Wales for October, 1913, it is reported that a solution of 1 lb. arsenite of soda to 3 to 4 gallons of water forms an effective weed killer if applied with an ordinary watering-can. In this case it is advised that after use the watering-can should be rinsed out with hot water, and that all stock should be kept off the treated area for at least four weeks after spraying.

The Agricultural Outlook.

Reports indicate that the winter wheat crop is doing well, and that the acreage has been considerably increased. Our bill for wheaten flour and wheat imported last year amounted to over £120,000, so it will be seen that we are still a long way from supplying our requirements. The maize crop is expected to equal in yield that of last season. Some difficulty is being experienced in shelling the grain, owing to the moisture content, which is greater than usual at this time of year. This is due to late rains and late frosts. It should be remembered that no grain will be accepted for export if it contains moisture in excess of 12 per cent. The tobacco crop last season was well grown and fairly well handled, but the leaf suffered severely from bacterial spot. The total yield is not yet known, but it is expected to reach 3½ million pounds weight of Virginia and half a million pounds of Turkish. A large proportion of the crop was graded on the farm this year, and, generally speaking, the work was well done.

Cattle are reported to be in good condition, and except for sporadic outbreaks of quarter-evil and infectious abortion, are comparatively free from disease. The rate of increase is very satisfactory and mortality figures are low. Natives are realising more the benefits of dipping their stock, and the practice is becoming much more general. The grass is drying out, but the grazing for this time of the year is exceptionally good, and stock should winter well. There is a serious falling off in our exports of slaughter cattle, a matter which is dealt with elsewhere in this *Journal*. On the other hand, our exports of butter show a very satisfactory increase, the figures for the first four months of the present year totalling £30,118, against £12,396 for the corresponding period of last year. It is worthy of note that Great Britain's imports of butter during May this year amounted to £4,443,807, and that of this total New Zealand contributed nearly half.

Correspondence.

USES OF MAURITIUS HEMP POLES.

To the Editor,
Rhodesia Agricultural Journal.

In view of the fact that Mauritius hemp has been planted on many farms in Rhodesia, either as a commercial proposition or simply for purposes of ornamentation, and that little or no advantage is taken of the seed poles, the writer would like to bring to your notice the utility of these poles as a cheap, highly efficient and easily worked building material for the farm.

The poles, if cut at maturity and dried, measure approximately 19 ft. long with $2\frac{1}{2}$ in. tips and $4\frac{1}{2}$ in. butts. They are borer proof and dead straight. They are lighter and more durable than gum poles, and are capable of supporting as great a weight as gum poles of the same dimensions.

In many cases no doubt these qualifications have been realised, but the fact that the poles are liable to split and will not hold a nail has been sufficient to condemn them in favour of other material. This drawback, however, can be overcome in structural work by making all joints "half-check" and binding with hoopiron and tying wire. Care must be taken that the poles are thoroughly dried out before "half-checking," otherwise they will buckle and crack. The poles are so easily cut with saw, chisel and adze that the work of cutting and fitting can be done as the work of erection proceeds.

The following are examples of what can be constructed with satisfactory results:—Roof principals up to 18 ft. span capable of carrying either iron or thatch; roof frames for circular huts up to 20 ft. diameter; internal scantlings of almost any nature, especially hanging racks for tobacco barns; hay racks, pens for live stock, hurdles, gates, ladders, etc., etc.

J. S. RALSTON.

Farming Calendar.

August.

BEE KEEPING.

Now that warmer weather prevails, hives can be opened with safety and examined. Do this when the sun is shining and without exposing the bees too long. The queens are now laying, and, should there be a scarcity of food, feed the bees with syrup inside the hive. Where a hive carries a fair supply of honey, queens can also be encouraged to produce eggs by crushing with a knife blade the cappings of sealed honey still remaining in brood combs. This month and next bees will be collecting nectar and pollen from fruit and bush bloom. Where strong south-easterly winds prevail, hive entrances should be shielded. This will afford bees great assistance in their going out and coming in.

CITRUS FRUITS.

Orange trees should already have been pruned, and should now be ready for the first irrigation. The first growth should be commencing early in the month, and by this time the trees should already have had one good soaking. As soon as the trees have set their fruit they should never be allowed to stop growing through lack of moisture, otherwise the fruit is liable to be poor in quantity and lacking in quality. After irrigation, cultivation should follow, and the earth round the trees be loosened with a spade. If fertiliser is to be used, it should be applied after the first irrigation, so as to be thoroughly incorporated with the soil in the cultivation following.

CROPS.

Provided there are no heavy frosts, dhal may be allowed to remain until August before harvesting. As a second or third year crop, dhal can always be cut earlier, say towards the end of June or in July. Castor beans should be harvested as the pods ripen, which they continue to do for a considerable period. Ploughing should be undertaken continuously wherever possible; the value of early ploughing cannot be over-estimated. Ploughing should be followed as soon as possible by harrowing. Mangels can be pulled and fed as required. The ensilage pit can now be opened, and the contents fed. Seed potatoes should be worked over, and decayed tubers removed.

Crops under irrigation will require but little attention. In oat crops, where the seed has been obtained from the Union, care should be taken to weed out any Drabak or Darnel (*Lolium temulentum*) that may be growing among the crop, as the presence of this weed is injurious. Care should also be taken not to over-irrigate any of the lands.

ENTOMOLOGICAL.

Potato.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with an arsenical wash.

Cabbage Family.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by webworm. Do not spray plants of which the foliage is to be eaten within three weeks of use.

Onion.—May still be troubled with thrip. Use tobacco wash or paraffin emulsion.

Deciduous Fruits.—Any trees infested with scale may be sprayed with a winter wash during August. Lime sulphur salt wash or scaleside is recommended.

Guava.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

FLOWER GARDEN.

This is a busy month, and the soil should be kept in good tilth. Roses, shrubs and ornamental trees may be planted. All seeds may now be sown. Marguerite carnations sown now will flower by the end of the year. Cuttings of carnations and other perennials should be planted either in the open ground or in boxes, using loose and well-decomposed soil for the latter, taking care that they are well drained, or the success will be small.

FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they shew a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

GENERAL.

Fireguards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

POULTRY.

By the end of this month all those who are not able to give very much attention to the chicks while in the growing stage should have stopped hatching. Those who can give some extra care to make war on insects should keep the chicks in the shade, and watch them carefully. They can continue hatching for another month, but not later, for if they do, the result will be slow growth and weediness in the young stock, deferred maturity and fewer eggs later. Now that the hot weather is approaching, a constant war on insects must be carried out, and of these sand fleas and fowl ticks (often erroneously called tampanes) will be found the most troublesome.

Sand fleas, as most poultry keepers know, are found on the face, wattles, ear lobes and combs. Application of any grease will kill them, as they breathe through pores in the skin; if these are stopped up, the insect is suffocated. More than this is, however, necessary, for the breeding quarters of these insects (and they multiply very rapidly indeed) is in the dust of the floor of the house and that of the run. Therefore the floor should be hard and smooth. The latter should be treated every week in one of the following ways:—

- (1) thorough soaking with a solution of a teacupful of Kerol or Jeyes' Fluid, etc., to a paraffin tin of water;
- (2) a strong solution of salt and water;
- (3) dusting over and raking into the soil a mixture of 1 part of flowers of sulphur and 2 parts of finely powdered lime.

Unless this treatment is carried out, constant trouble will be caused by these insects, which tend to stop the growth of chicks and young birds and lessen the output of eggs from the adult birds.

STOCK.

Cattle.—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On diorite farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains.

The bulls may again be put back into the herds. Any very young calves should be kept near home, and dipping should be carefully attended to. In dairy herds on any soil whatever, feeding, housing and bedding cannot be relaxed. Cows in full milk will benefit by a ration of, say, 5 lbs. of maize (crushed and soaked), 30 lbs. to 40 lbs. of ensilage or pumpkin and 8 or 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of peanuts, crushed with the shell, or linseed ground with maize, or peanut cake, a very great benefit will be derived. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. It will pay to feed to them a little sweet hay, bean meal, linseed, peanuts or peanut cake and a small ration of green food.

Sheep.—Sheep should give little trouble at this time of the year, but on very dry veld a handful of mealies and a little hay or ensilage will materially assist ewes with young lambs.

VEGETABLE GARDEN.

All vegetable seeds may now be planted. Those having but a limited supply of water would be wise to sow in boxes, transplanting when large enough. The seed beds require careful preparation; they should be well raked up and laid out in long narrow rows in order to facilitate watering. The tops of the beds should be levelled as near as possible, and when sown, covered over with a thin layer of straw or grass, which will prevent the seeds being washed out when watering and the soil from caking.

VETERINARY.

Redwater and gallsickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

September.

BEE KEEPING.

In sheltered localities many trees in the bush will now be in bloom. Should there be indications of swarming, put on a crate of sections or shallow frames, correctly fitted with super-foundation. Where a swarm has been secured, place it in a modern hive, and from an established stock remove a frame of comb containing unsealed brood and honey, shake off the adhering bees on to their own alighting board, then insert this comb into the centre of the newly hived swarm. This plan compels the bees to start work at once. As a means of preventing the escape of the queen, a narrow strip of excluder zinc may be fastened at the entrance. This should be removed after about two weeks.

CITRUS FRUITS.

If the trees were irrigated early in August, the next application of water should be given about the first or second week of this month. After irrigation, cultivation should follow. Constant attention should be given to young trees, and a watch kept for any adventitious shoots or suckers, which should be cut away at once. This should be attended to right through the growing season.

CROPS.—See August.

ENTOMOLOGICAL.

Tobacco.—Young plants in seed beds may suffer from cutworms. See Bulletin No. 347.

Potato.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

Cabbage.—During this month the most prominent enemies of plants of this family are diamond back moth and webworm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

Beans planted under irrigation during September usually escape serious infestation with stem maggot.

Citrus Trees.—Scale insects commence to increase rapidly with the advent of warmer weather, but the trees should not be sprayed or fumigated while in blossom.

FLOWER GARDEN.

Although our spring advances with this month, rains are very uncertain and usually scarce, but in spite of circumstances plants now grow with very little encouragement. Perennials and shrubs should be well attended to, especially those which flower early; the soil should be kept well stirred around the stems, and they should be watered if necessary.

Practically all flower seeds may now be sown in boxes, nursery beds, or in the open ground where they are to be grown. Nursery beds are perhaps preferable, as a great deal of watering may have to be resorted to on account of late rains. All annuals sown in July should now be ready for transplanting; should these be few, and a larger show of flowers desired, the heads may be pinched out after planting, which makes the plant spread out more and become bushy. Shrub and ornamental tree seeds should be sown now if desired for planting out during the rainy season, and may be sown in the open; if it is desired to hasten them they should be planted in boxes and covered with glass, and placed in a sunny position sheltered from the winds. If summer bulbs have not already been re-planted, this should be done at once; they sprout as the weather becomes warmer, and, if allowed to do this before planting, the bulb loses much of its vigour. It must be borne in mind that all bulbs that cluster, if divided, produce better blooms, and the plants have a better appearance than the old cluster, which has a lot of decayed matter and generally a ragged appearance; this also applies to those perennials which may be increased by division of roots.

FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. All gum seeds should be planted now if it is intended to grow the transplants in tins. If they are to be grown in beds only, don't plant gum seeds until next month. The seed beds may with advantage be prepared now and watered to make the weed seeds germinate, so that they may be destroyed before planting next month.

GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

POULTRY.

During the dry weather the supply of such green food as lettuces, cabbages, etc., becomes less, but there are many others which may take their place. For instance, the three following:—Billambara, plumbago and wild cockscomb, which are even better than lucerne. Other good green foods are Beira creeper, potato creeper, bougainvillea and Napier fodder. All green foods given to the birds—and they cannot possibly be given too much, for they greatly increase the egg production, and tend also to increase the size of the egg—should be chopped small and put in dishes or troughs. The method so often adopted of throwing it down whole to the birds cannot be too severely condemned; it becomes dirty and withered, and much of it is therefore left by the fowls. Many of the young cockerels should be now fit for killing. Keep the best and get rid of the remainder, for to keep the poor ones means only so much waste of food and labour. They will never be profitable or fetch more than killing price. While on this subject of disposing with unprofitable birds, it would be as well to mention that a large number of birds in the country have been individually examined and graded into three grades, viz., *1st grade*, those which with proper treatment should lay over 180 eggs in the year. These the owner should keep for breeding from, or for selling privately at a remunerative price for the same purpose. *2nd grade*, those laying from 100 to 180 per year; not good enough to breed from, but profitable from the point of view of producing eggs for food. *3rd grade*, those laying less than 100 eggs per year. These birds are not profitable, and are only fit for killing. All should be (many frequently are) killed at home, or sold either to private customers or on the market, but, needless to say, on this basis. It would be as well here to repeat (and evidently judging from observation it is necessary to constantly do so) that it is absolutely necessary to have a constant and unlimited supply of *hard sharp* grit, each piece being about the size of a wheat grain, before the birds; also granulated wood charcoal of a similar size. Many poultry keepers do not recognise the fact that nature has not provided fowls with teeth in order to masticate their food, and unless they can do so, digestive troubles of all kinds are the result, followed by malnutrition, ill-health, no eggs and unprofitableness, and the unpleasant aspect of a miserable lot of creatures moping about. This hard sharp grit mixes with food in the gizzard, and, by a rotary movement caused by the strong muscles of this organ, grinds up or masticates the food. Oyster shell, or what is called shell grit, is neither hard enough nor sharp enough, and is only used to supply lime for the egg shells. Charcoal is given as a blood purifier and germicide; as a general corrective it is invaluable for this purpose. Therefore, it is hopeless to attempt to keep fowls healthy and profitable without these two most important necessities.

STOCK.

Cattle.—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary, and seeing that they do not get too poor. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance.

Sheep.—The remarks for August apply. If spring lambs are expected, it will be wise to see that the sheep shed is in good order—clean, dry, properly drained and airy. Watch that the ewes shall not be poor when they lamb, and remember that they cannot rear good lambs if the veld is bad, but must have their grazing supplemented, just as milk cows are fed in order to produce milk.

TOBACCO.

Begin sowing seed beds each fortnight for the acreage proposed to be planted; fertilise and stimulate growth so as to be ready for planting out should rain come early in November.

VEGETABLE GARDEN.

Most seeds may now be sown, though there is risk of losses from want of rain. Watering, of course, can be resorted to. Marrows, pumpkin, melon, cucumber and peas may be planted in the field after the first rains. Tomatoes that have been sown earlier should be planted out, and these as they come on should be staked.

VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shews slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

Weather Bureau.

RAINFALL.

STATION.	1921.		Annual Total.
	May.	June.	
MASHONALAND :			
Charter—			
Buhera	0.26	...	20.63
Marshbrook	0.57	0.04	30.72
Range	0.56	...	36.63
Riversdale Farm	...	...	24.61
Vrede	0.67	...	31.92
Chibi—			
Lundy	1.54	...	23.25
Nuanetsi Ranche (Homestead)	0.16	...	10.45
Chilimanzi—			
Driefontein	2.55	0.01	23.42
Felixburg	0.73	...	26.30
Induna Farm	1.60	...	31.90
Wylde Grove	0.74	...	26.38
Gutu—			
Eagle's Nest Ranche	0.65	...	22.96
Glenary	0.54	0.05	23.92
M'vimvi Ranche	0.69	...	28.41
Hartley—			
Ardgowan	1.10	...	38.14
Carnock	1.46	...	33.94
Cringleford	1.60	...	39.89
Elvington	0.82	...	33.68
Gatooma	0.25	...	40.04
Gowerlands	2.74	0.02	35.52
Hartley Gaol	0.90	...	36.22
Pollockshields (n.s.)	2.48	...	—
Ranwick	0.46	...	40.62
Spitzkop	0.55	...	32.23
Inyanga—			
Rhodes Estate	2.90	0.23	—
St. Trias' Hill	2.22	...	35.48
Lomagundi—			
Gambuli (Mukore)	1.10	...	30.90
Mukwe River Ranche	0.96	...	29.71
M'Vaami Farm	0.78	...	33.73
Palm Tree Farm	1.44	...	30.23
Sinoia	0.69	...	26.51
Sipolilo	1.14	...	29.06
Makoni—			
Chimbi Source	1.60	0.05	29.36
Craigendoran	2.30	0.13	26.87

*Rainfall Deviation from
Normal in
SOUTHERN RHODESIA
1920-21*

Scale 1 inch = 100 miles

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RAINFALL—(Continued).

STATION	1921.		Annual Total.
	May.	June.	
MASHONALAND—(Continued)			
Makoni—continued			
Eagle's Nest Rancho ...	3.76	...	34.32
Forest Hill ...	0.98	0.69	26.06
Gorubi Springs ...	0.61	1.04	31.01
Mona ...	1.67	0.08	29.85
Monte Cassino Mission ...	1.75	...	32.19
Marandellas—			
Delta ...	1.81	...	34.65
Land Settlement Farm ...	0.92	0.73	30.48
Mazoe—			
Citrus Estate ...	1.62	...	37.81
Craigengower ...	1.14	...	28.81
Kilmer ...	1.38	...	...
Kingston ...	0.85	...	38.53
Marston Farm (n.s.) ...	0.96	...	28.38
Ruoko Rancho ...	2.26	...	36.82
Rustington ...	0.53	...	26.41
Stanley Kop ...	2.08	...	30.46
Woodlands Farm ...	0.85	...	36.50
Melsetter—			
Brackenbury ...	1.75	1.74	55.39
Chikore ...	1.49	...	41.07
Chibuzana ...	1.96	—	...
Helvetia ...	2.11	0.33	57.63
Chipinga ...	0.58	...	41.64
Melsetter ...	2.23	1.05	40.79
Mount Selinda ...	4.27	0.12	50.25
Tom's Hope ...	1.02	0.44	47.77
Vermont ...	2.42	0.27	60.03
Mtoko—			
Makaha ...	...	...	31.38
Mtoko ...	0.47	...	27.58
Ndanga—			
Doornfontein ...	0.60	0.01	24.55
Salisbury—			
Borrowdale (Hatchliffe) ...	2.07	...	40.67
Bromley ...	3.26	...	30.41
Cleveland Reservoir ...	2.95	...	39.06
Forest Nursery ...	3.08	...	29.22
Goromonzi ...	3.81	...	38.62
Gweli ...	1.66	...	26.71
Tisbury (W. Commonage) ...	3.05	...	34.25
Vainona ...	2.99	...	34.32
Umtali—			
Gilmerton ...	0.40	0.11	24.01
Odzani River (Power Station) ...	1.07	0.67	33.69
Premier Estate ...	0.71	0.46	24.30
Umtali (Gaol) ...	0.14	...	21.28
Sarum ...	0.22	0.25	24.80
Stapleford ...	1.39	0.72	57.10
Stralsund ...	0.48	0.22	28.01

RAINFALL (*Continued*).

STATION	1921.		Annual Total.
	May.	June.	
MASHONALAND—(Continued)			
Victoria—			
Gokomere Mission	0.72	0.15	26.73
Jichidza Mission	0.42	...	43.32
Morgenster Mission	0.71	...	59.94
Riverdene North	0.68	0.05	23.54
Silver Oaks	0.68	0.30	23.38
Stannmore	0.50	0.03	18.09
Summerton	0.14	0.19	22.91
Victoria	0.73	0.19	23.34
Histonhurst (D.S.)	0.26	...	25.19
MATABELELAND :			
Belingwe—			
Bubje Ranche	10.1	...	21.25
Bubi—			
Imbesu Kraal	1.06	...	29.56
Bulalima-Mangwe—			
Garth	1.14	...	35.54
Riverbank Farm	0.69	...	29.96
Solusi Mission	0.86	...	30.33
Tjankwa	1.71	...	31.54
Tjompanie	2.01	0.01	31.82
Bulawayo—			
Lower Rangemore	0.66	...	26.73
Gwanda—			
Gwanda (Gaol)	0.39	...	25.09
Mtshabezi Mission	0.67	...	21.75
Gwelo—			
Cross Roads Farm	1.13	...	30.59
Dawn	0.57	...	31.89
Globe and Phoenix Mine	1.28	...	32.50
Gwelo (Gaol)	2.04	0.14	31.05
Lover's Walk	1.68	...	35.25
Oaklands	0.37	0.05	39.79
Partridge Farm	0.73	...	34.30
Somerset Estate	0.86	...	31.44
Sheep Run Farm	0.92	...	27.80
Insiza—			
Filabusi	0.16	...	30.92
Matobo—			
Rhodes Matopo Park	1.85	0.02	33.26
Nyamandhlovu—			
Naseby Farm	0.60	...	39.55
Sebungwe—			
Gokwe	0.74	...	40.04
Selukwe—			
Rio	0.48	0.08	34.24
Umzingwane—			
Essexvale	0.35	...	29.66
Wankie—			
Wankie Hospital	0.04	...	22.88

... means nil.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1921			
			August	September	October	
Banket Junction ..	Banket Junction ..	C. Anderson	..	3	1	
Beaufort ..	Beaufort ..	G. Askew	6	10	8	
Brinsley ..	Brinsley ..	C. R. Duay	13	1	6	
Charter—Mgezi ..	Farmers' Hall, Beatrice	W. Krienke	4	29	27	
Central ..	Umvumba ..	M. W. Graham	25	30	..	
Darwin ..	Arcadia Farm and Mt. Darwin Store alternately	J. W. Giles	..	11	9	
Eastern Border (South Melsetter)	Farm Havenswood ..	J. R. Scott	14	9	14	
Eastern Districts ..	Good Hope ..	J. R. Scott	13	10	8	
Elliot ..	Acting Hotel ..	J. Watson	3	7	7	
Felixburg—Guta ..	Noelde Farm and Felixburg	W. K. Hudson	13	10	8	
Figtree Branch, R.L. and F.A.	Figtree Hotel ..	E. Laing	27	24	22	
Gaba ..	Hunyani Drift ..	A. Kelsey-Harvey	18	15	20	
Gatoona ..	Gatoona ..	E. Seale	..	fixed	dates	
Gazaland ..	Chipinga ..	W. Wood	..	15	..	
Greystone ..	Various farm houses, Shungu	M. Kelen	..	20	17	
Groote ..	Edwards Hotel, Gwanda ..	J. de L. Nimmo	16	24	22	
Haritla ..	Harley ..	J. Grewar	27	fixed	dates	
Headlands ..	Headlands ..	R. W. Twilley	13	10	8	
Hunter's Road Farmers and Stockowners	Hunter's Road Sitting ..	M. E. Weale	..	..	17	
Inisa—Shangani ..	Shangani ..	E. J. Hacking	20	10	8	
Inyanga ..	Farm Juliusdal ..	E. H. Both	13	20	17	
Inyazura ..	Inyazura ..	E. J. Hacking	15	10	17	
Lalepansi ..	Lalepansi ..	E. J. Hacking	13	10	15	
Madzimbiri ..	Madzimbiri ..	E. J. Hacking	..	fixed	dates	
Macheke ..	Macheke ..	W. J. McLean	..	16	21	
Makwiro ..	Makwiro ..	D. M. Syme	19	25	26	
Makoni North ..	Mr. Wiggall's Farm, Makoni South	J. G. Monekton	31	10	8	
Makoni ..	Rusape ..	W. B. Tapson	13	10	1	
Marandellas, Northern ..	Marandellas Farmers' Hall	A. V. Stanley	6	3	7	
Marandellas, Southern ..	Inoro ..	A. E. Scott	..	..	..	
Mashonaland ..	Commercial Hotel, Salisbury	C. Allen	..	..	..	
Mazoe Branch, R.L. and F.A.	Commercial Hotel, Salisbury	C. Allen	..	..	..	
Mazoe ..	Commercial Hotel, Salisbury	C. Allen	..	..	..	
Mazoe Central ..	Glendale Sitting ..	Mrs. Yeakall West	10	fixed	dates	
Melsetter ..	Melsetter ..	J. D. Peace	12	9	14	
Melsetter (North) ..	Cronley ..	J. Harvie	..	3	..	
Midlands Farmers and Stockowners	Royal Hotel, Gwelo ..	R. Woodhouse	9	16	11	
Northern Unital ..	Farm Summerfield ..	M. Panzger	..	..	..	
Northern Unital ..	Farm Summerfield ..	A. Tulloch	..	..	..	
Que Qu ..	Norton Store ..	A. Wrench	26	27	27	
Rhodesian Landowners and Farmers	Library Buildings, Bulawayo	E. J. Hopkins	29	17	15	
Selous ..	Various farms ..	A. L. Douglas	..	..	..	
Selukwe ..	Selukwe ..	E. E. Somerset	..	..	..	
Shanva ..	Shanva ..	Capt. N. Stanley Stadard	18	15	20	
Unvukwe ..	Various ranches ..	Capt. G. H. Gordon	13	17	15	
Unital ..	Royal Hotel, Unital ..	J. S. Holland	4	1	6	
Victoria ..	Victoria ..	Mayor A. J. Dunn	3	2	7	
Western ..	Funtree Hotel ..	W. R. Boucher	13	19	8	

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st September until 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all collection and forwarding, and railway charges. Sufficient seed of each kind to sow one-quarter to one-half an acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture, Salisbury.

Summer Oats.—Sixty-day or Kherson, Burt.

Rice.—Dryland or hill rice (for wet vleis).

Oil Seeds.—Linseed, sunflower, Spanish ground nuts.

Legumes.—White stingless velvet beans, dolichos beans, sunn hemp (for green manuring), dhal, beggar weed (a valuable dryland substitute for lucerne), lupins (a green manure crop for sandy soil), Black-eyed Susan field pea, kudzu vine, sweet clover.

Hay Crops.—Teff grass, manna, red manna.

Pasture Grasses.—Kikuyu grass, African star grass, Rhodesian tussock grass (a few roots of each sufficient to start a small nursery).

Miscellaneous Crops.—Buckwheat, Niger oil (for green manuring), sweet potato vine cuttings.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

Farmers who are interested in the native grasses, legumes, weeds, etc., which occur on their farms are invited to send specimens to the Department for determination and naming.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three to seven days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) colour and appearance of flowers;
- (c) class of soil on which found;
- (d) locality and altitude;
- (e) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

All specimens and correspondence on this subject should be addressed to the Chief Agriculturist and Botanist.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are on rail Salisbury, plus a small charge for collection and forwarding fees Salisbury, or f.o.r. the Gwebi experiment farm.

On account of the limited supply available in some cases, it is impossible to guarantee the full delivery of any order. Farmers are therefore requested not to enclose cheques until they are advised as to

the amount of seed allotted to them. The seeds are consigned carriage forward in the case of stations. In the case of sidings, the amount of railage will be notified after despatch.

Hickory King maize, 20s. per 100 lbs., selected hand-picked seed.

Salisbury White maize, 20s. per 100 lbs., selected hand-picked seed.

Ground nuts (Spanish), unshelled, 20s. per bag.

White stingless velvet beans, 20s. per 100 lbs.

Black-eyed Susan pea, 25s. per 100 lbs.

Sunflower seed, 15s. per 100 lbs.

Teff grass, 9d. per lb.

Manna, 4d. per lb.

Sunn hemp, 3d. per lb.

Niger oil, 3d. per lb.

Linseed, white flowering, 6d. per lb.

Majorda melon seed, 1s. 6d. per lb.

Buckwheat, 2d. per lb.

Sweet potato slips, 5s. per 100 slips

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes of Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.

- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16. Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley.
- No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
- No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
- No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops, 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 307. Rainfall Statistics, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.

LIVE STOCK.

- No. 125. Feeding and Care of Imported Bulls, by R. C. Simmons.
 No. 146. Notes on Cattle Breeding, Part II., by R. C. Simmons.
 No. 163. Feeding and Care of Imported Cattle, by R. C. Simmons.
 No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
 No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by R. C. Simmons.
 No. 227. An Experiment in Beef Production, by R. C. Simmons.
 No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
 No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
 No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 No. 255. Pound Fees.
 No. 284. Establishment of a Dairy Herd on a Granite Veld Farm by a New Settler, by R. C. Simmons.
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
 No. 288. Stock Records for Ranches in Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 292. Branding and Drafting Pens, by R. C. Simmons.
 No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
 No. 323. Bacon Curing on the Farm, by Jas. B. Fisher, N.D.D.
 No. 331. Theory and Practice of Feeding Cattle in Southern Rhodesia, Part I., by R. C. Simmons.
 No. 332. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part II., by R. C. Simmons.
 No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
 No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
 No. 336. Butchering and Flaying.
 No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
 No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
 ——— Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 243. Shedding for Milch Cows, by R. C. Simmons.
 No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 284. Establishment of Dairy Herd on Granite Veld, by R. C. Simmons.
 No. 308. Cream Cheese, by J. B. Fisher, N.D.D.
 No. 311. Gouda Cheese Making, by J. B. Fisher, N.D.D.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 95. Oestrus-ovis in Sheep, by Alec King.
 No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
 No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
 No. 272. African Coast Fever: Schedule of Outbreaks to 1916, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.
 No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
 No. 312. Anthrax, by C. R. Edmonds, M.R.C.V.S.
 No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
 No. 316. Inoculation of Cattle against Redwater and Gail-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
 No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
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- The Analyses of Agricultural Products, Soils, Water, etc.
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Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 290 of 1921.]

[10th June, 1921.

ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 131 of 1920, and in terms of section 17 of Government Notice No. 21 of 1917 declare the following area of infection and guard area in lieu of those fixed by the first-mentioned notice:—

MAZOE NATIVE DISTRICT.

(a) *Area of Infection.*

Farms Rocky Spruit, Avonduur, Wolf Hill, Sleamish, Virginia, Virginia Extension, Leopard's Vlei.

(b) *Guard Area.*

Farms Glendale No. 4 and No. 28, Seddies, Dalnegreine, Glen Divis, Kasipa, Clifton, and that portion of Glen Grey lying east of the main road running from Glendale Station to the Umrodzi River.

No. 291 of 1921.]

[10th June, 1921.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 131 of 1920, and in terms of section 17 of Government Notice No. 21 of 1917 declare the following area of infection and guard area in lieu thereof:—

MAZOE NATIVE DISTRICT.

Area of Infection.

The farms Rocky Spruit, Avondunn, Leopard's Vlei, Wolf Hill, Sleamish, Virginia and Virginia Extension.

Guard Area.

The farms Glen Divis, Dalnegreine, Clifton, Glendale No. 4 and that portion of Glen Grey lying east of the road from Glendale Station to the Umrodzi River.

No. 332 of 1921.]

[1st July, 1921.

ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notices Nos. 505 of 1920 and 73 of 1921, and in terms of section 17 of Government Notice No. 21 of 1917 to declare the following areas of infection and guard areas in lieu thereof:—

MELSETTER NATIVE DISTRICT.

(a) *Area of Infection.*

The farms Glencoe, Hayfield, Mermaid's Grotto, Rumble Rills, Tarka, Springfield, Tilbury, Dunstan and Welgelegen.

(b) *Guard Area.*

An area comprising the unalienated land lying south and east of area of infection (1) defined above and between it and the Anglo-Portuguese boundary, the farms Springvale, Orange Grove, Roede, Nyhodi, Stonehege and Chamois.

MELSETTER AND UNTALI NATIVE DISTRICTS.

(a) *Area of Infection.*

The farm Quagga's Hoek.

(b) *Guard Area.*

The farms Kronstad, Lombard's Rust, Ostend, Thaba Nchu, Penkridge, McAndrews, Lisnacloon, Ruwaka, Bulls Run, Pieters Hoek and the Mutambara Reserve, excluding a strip two miles wide along the Odzi River, bounded on the north by the Umvumvu River and on the south by the Nanyadzi River.

No. 256 of 1921.]

[20th May, 1921.

CATTLE CLEANSING ORDINANCE, 1918.

IT is hereby notified that His Honour the Administrator in Council has been pleased, under the provisions of section 8 of the "Cattle Cleansing Ordinance, 1918," to cancel section 2 of Government Notice No. 477 of 1920, and to declare the following in lieu thereof:—

"2. That portion of the native district of Inyanga lying east of a line drawn from the Anglo-Portuguese boundary up the Ruenya and Chinyika Rivers to the confluence of the Inyamakwakwa River with the latter; thence in a direct line eastward to the north-western beacon of the farm Wheatlands; thence along the northern boundaries of the same and Barrydale to the north-eastern beacon of the latter; thence southwards along the western boundaries of Scotsdale, Inyanga Block, Holdenby and Umtasa North Reserve to the Hondi River.

Ports of Exit—Matiza Dipping Tank and Inyanga Slopes."

No. 268 of 1921.]

[27th May, 1921.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920."

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Walter Abbott ...	Marodzi	Loma-gundi.	Farm Baguta.
Lewis Stanhope Amos Vereker ...	Unnamed tributary of the Umwindzi.	Salisbury	Farm Carrick-creagh.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 284 of 1921.]

[3rd June, 1921.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
The Thorneycreek Ranching Co., Ltd.	Drai	Loma-gundi	Farm Lone Cow Estate
The Thorneycreek Ranching Co., Ltd.	Seedji	Loma-gundi	Farm Lone Cow Estate
Ainslie & Charlesworth	Tanda-fusi	Loma-gundi	For generation of power on farm Birkdale.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 300 of 1921.]

[10th June, 1921.

*Applications for Use of Water in terms of the "Water Ordinance, 1913,"
as amended from time to time*

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
E. Ross Townsend	Tatagura	Mazoe	Farm Passaford
Liebig's Extract of Meat Co., Ltd.	Mte-tengwe	Gwanda	Jopempi Block

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 313 of 1921.]

[17th June, 1921.

*Applications for Use of Water in terms of the "Water Ordinance, 1913,"
as amended from time to time.*

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	From what river	Native district of	For the purpose of irrigating a certain portion or portions of the
Basil Henry Jones	Konongwe Spruit	Gwanda	Farm Konongwe
Rhodesia Lands, Limited	Marodzi	Mazoe	Farm Belford Estate

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 338 of 1921.]

[1st July, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For generation of power on
A. Crossley	Impali River	Selukwe	Farm Impali Source

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within fourteen days from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 345 of 1921.]

[8th July, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant.	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Dawson and Klette	Umrodzi	Mazoe	Farm Sable Peak.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge within two months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 352 of 1921.]

[15th July, 1921.

Application for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following application has been made for authority to use water :—

Name of applicant	From what river.	Native district of	For the purpose of irrigating a certain portion or portions of the
Aletta Catharina Munch	Matindiza	Makoni	Farm Mona

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within three months from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of this application, together with a full statement of the grounds for such objections.

No. 289 of 1921.]

[10th June, 1921.

IMPORTATION OF PLANTS REGULATION ORDINANCE, 1904.

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to prohibit the introduction into Southern Rhodesia from the Union of South Africa of any cotton seeds, or any cotton seeds with lint attached, except under the authority of a permit, the granting of which shall be at the discretion of the Director of Agriculture, who may attach such conditions to the importation as he may deem desirable.

Any person guilty of a contravention of the provisions of this regulation, or of any of the conditions imposed upon any permit granted in terms thereof, shall be liable to a fine not exceeding £10.

BEIRA & MASHONALAND & RHODESIA RAILWAYS

Reduction in Rates for Maize, Maize Meal, etc., for Export to the Union.

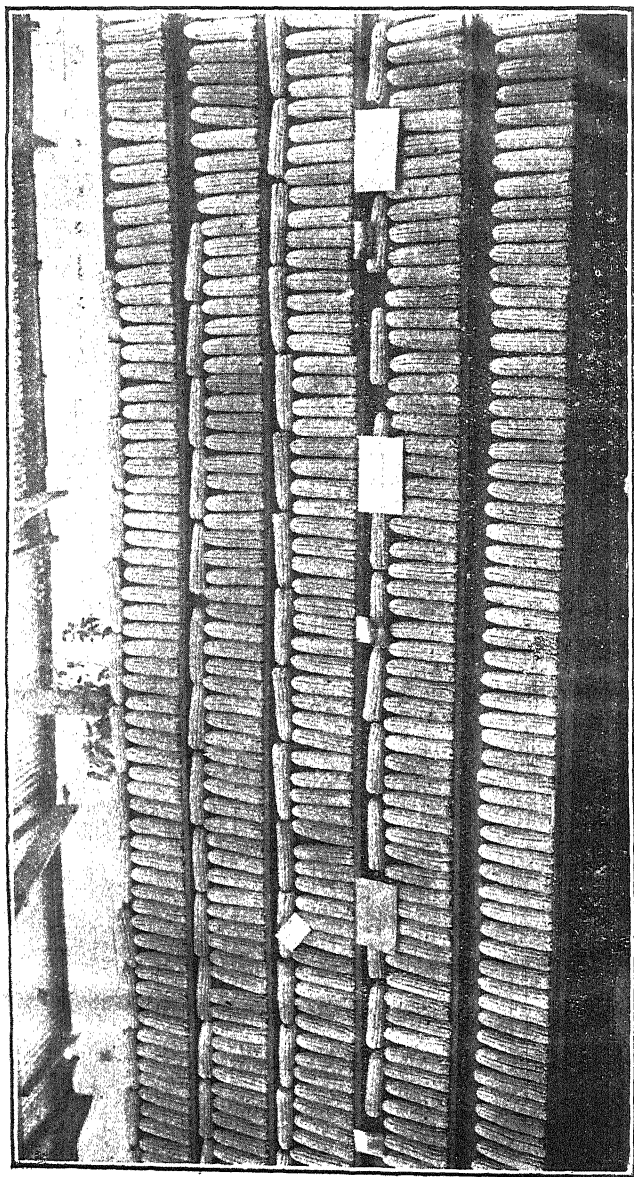
With effect from 1st July, 1921, Maize, Maize Meal, Samp, etc., in full truckloads, consigned from Rhodesia to Palapye Road and beyond, will be charged at the following reduced scale of rates :—

Miles.	Per ton. s. d.
1—225	15 0
226—350	19 6
351—475	23 6
476—600	25 0
601—800	27 6
801—1,000	30 0
1,001—1,200	32 6
1,201—1,300	33 9

Further particulars may be obtained on application.

Bulawayo, 11th June, 1921.

C. F. BIRNEY, General Manager.



Mr. D. W. Bean's 500 ears Salisbury White maize, Grand championship
at Salisbury and Johannesburg, 1921. (See notes on opposite page.)



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[No. 5.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Our Maize.—The awards at the recent Rand Maize Show constituted yet another triumph for Rhodesian maize, which, in addition to winning numerous prizes, again carried off the Grand Championship for the best exhibit of 500 ears of any variety on the show. To Mr. D. W. Bean's exhibit of 500 ears of Salisbury White, which won the Grand Championship at the Salisbury Show, went the supreme honours, and his successes are well deserving of record: 1st and champion, single ear, any other variety white, Salisbury White; 1st, champion and grand champion, 200 ears, any other variety white, Salisbury White; 1st, champion and grand champion, 500 ears, any other variety white, Salisbury White; 1st, champion and grand champion, 10 ears, any other variety white, Salisbury White; 2nd and reserve champion, ten bags, any other variety white, Salisbury White—all low veld.

It is believed that these successes constitute a South African record.

Mr. Bean also won the "Sam Hyde" cup for scoring the highest number of points with any one breed of maize, as well as the "Sam Mottram" and Kleinenberg cups.

Summarised, the awards gained by other Rhodesian exhibitors are as follows:—T. H. Newmarch, Salisbury, 5 firsts, 3 seconds, 4 thirds, 1 commended, 1 champion; J. Watson, Salisbury, 2 firsts, 1 second; E. S. White, Concession, 1 first, 4 seconds, 2 thirds; F. C. Peek, Concession, 1 first, 2 seconds, 1 highly commended and reserve; Mrs. Wilson, Salisbury, 1 first, 1 second, 1 highly commended; T. D. Maclean, 1 second and reserve championship; Glanfield and Rattray, Bindura, 1 second; A. R. Morkel, Shamva, 1 third. Mazoe by two points missed winning the challenge cup offered to the district awarded the most prizes. Had it not been that an exhibitor inadvertently staged a 12-row ear in his exhibit of 10 ears Louisiana Hickory, Mazoe would have secured this trophy.

The remarks of the visiting judges at the Salisbury Show rather prepared us for these sweeping successes, and are worth repeating. Addressing a meeting of the Maize Breeders and Growers' Association, Mr. Walter Pepworth, the well known maize grower of Natal, said (*vide Rhodesia Herald* report): "He did not think there was any country in the world which could produce their magnificent exhibit of white maize." Mr. Horsfall expressed himself as follows:—"They had a most wonderful class of Hickory Kings of which he had never seen the like. He ventured to say that no other maize expert in the country or out of it had ever seen the like before. He went further than that: he was pretty well convinced that there was no country in the world capable of producing that exhibit."

These tributes confirm those expressed by other judges from the Union at previous Salisbury Shows, and, borne out as they are by results at Johannesburg, are convincing proof of the remarkably high standard to which the production of seed maize has been brought in Rhodesia. Those growers and breeders in particular who have continued to grow Salisbury White maize in the face of no little adverse criticism will be gratified at the signal success of their favourite variety. The marked improvement achieved in the type and uniformity of the ears and the plumpness of grain of Salisbury White is a striking tribute to the possibilities of the breed and to the care and attention given to its selection by those growing it.

Outlets for our Beef.—The activities of the Meat Producers' Exchange are receiving much attention from breeders and dealers alike. Prices of cattle are low, but it was precisely for this reason that this co-operative body was brought into existence; it would never have been thought of had the profit of the prime producer been considered adequate by him. There is good reason to suppose that prices would have been even lower but for this effort, and it is a somewhat unfortunate fact from the point of view of the co-operators that those persons who remain outside are benefiting by the activities of the

Exchange as much as those who have joined. The benefits of co-operation have been felt at once, but would undoubtedly be greater still if all stock raisers combined.

As regards Southern Rhodesia, there are as yet small signs of the existence of the Meat Producers' Exchange, although its opponents declare that its main object is to find a market for our cattle on the Rand; this is quite a mistake. The problem of the most economical and advantageous means of disposing of our live stock is exercising the minds of farmers all over Southern Rhodesia, and the Meat Producers' Exchange if organised to that end might accomplish the task.

Local markets are fairly well developed through recognised channels, but it is our ever increasing surplus which is causing anxiety.

The matter is being discussed by farmers' associations, who in certain instances evince a not unnatural anxiety to preserve local markets to local producers, creating, in fact, a barrier to trade greater than the natural one of distance from the centre of consumption. Such a parochial point of view seems to forget or neglect the common interest of all in finding outlets in the world's markets. For example, we are informed that ten per cent. of the cattle handled by the Meat Producers' Exchange are being exported, and this policy is having an important bearing on prices.

Unfortunately, Rhodesian cattle are not contributing their quota to this export owing to lack of condition on arrival at the abattoirs, which emphasises the point that our cattle should leave the country in frozen form.

The Maize Situation.—We have to record a fall in the price of maize to the lowest figure in the history of the country, the present quotation in Salisbury being about six shillings a bag, and no buyers even at that. This has not occurred suddenly, so the word "fall" is hardly accurate; "collapse" is perhaps more descriptive. The prospects of improvement are unfortunately remote, since the causes of the present situation are not local, but world-wide, and due to the inability of the usual markets to purchase our grain owing to economic and political circumstances throughout Europe. The world's price for maize is unprecedentedly low, and at the same time ocean freights are high and the cost of production has not fallen, whilst railway rates take over a third as much as the farmer himself gets.

The situation is undoubtedly serious. At six shillings per bag at the station or siding, the farmers are receiving no adequate return for their capital, time and labour, and many indeed may be so hard hit that they may be unable to continue; this would be a grievous loss to the country at large. With uncertainty as to the future, maize production must suffer. Many farmers have disregarded all warnings and concentrated on maize instead of producing other crops, such as fodder for stock, ground nuts and sunflowers, which latter two are to-day selling at remunerative prices for export.

Unless the position improves, for which at the moment there is no prospect, there is likely to be a much reduced acreage planted to maize in the coming season.

When the surplus of maize in the Union and Southern Rhodesia has been exported there may be an improvement in the price of that remaining, but the average price in any case will be very low.

Our Exports.—Mr. J. W. Downie, General Manager of the Rhodesia Farmers' Co-op. Ltd., was the principal speaker at a public meeting held in Salisbury during show week of those interested in the production of butter and bacon. Much that was said might be equally applied to our other agricultural exports, such as maize and meat. Mr. Downie made the point that as long as supplies were unequal to local needs the price was fixed by the world's market price, *plus* freight from country of origin; but as soon as supply overtook local demand the price was that obtainable overseas, *minus* freight to the centre of consumption. This hard truth has yet to be realised by many producers, and they must prepare for the inevitable fall in prices. Suggestions were made for the assistance financially by Government of undertakings concerned in rendering the raw products of the country fit for export. It was considered that bacon factories, creameries, oil mills, the cotton ginnery and the like should be assisted by guarantees of interest or by bonuses until the industries are firmly established. Another proposal made was the payment by the State, that is by general taxation, of the salaries of the experts employed in such factories, on the ground that their services benefited the whole community. The need was also emphasised of instructing producers in every means by which they could improve their products or economise in the processes of preparation and transport. This is a form of educative propaganda which cannot be undertaken by individual commercial concerns, and comes appropriately within the domain of the Government.

Mr. Downie gave some very enlightening facts and figures in emphasising the necessity for maintaining supplies of cream during the winter season. In January, he pointed out, 70,000 lbs. of butter were manufactured at the Gwelo Creamery against 9,600 lbs. in June. Overhead charges remain the same, and it is obvious that the cost of manufacturing butter at this period must be greater. Mr. Downie gave the figure as threefold. We support his plea for a more regular supply of cream in order that Rhodesia may successfully export butter. The same applies to pigs for the bacon factory. Here again supplies are erratic and inadequate, and Mr. Downie pointed out that working on a basis of 90,000 lbs. the overhead expenses were equal to 1d. per lb. To-day he said they were working nearer 30,000 lbs., and the result was that the overhead expenses were equal to 3d. per lb.

This provides food for thought, and we trust that the illuminating remarks made at this meeting will be read by all concerned in the development of these young industries with which the prosperity of the country is so closely connected.

Ground Nuts.—As is generally known, there has been a very considerable increase in the local production of ground nuts during the last two seasons, and the output of this crop has reached a stage when export has become necessary. Ground nuts now figure as one of the side crops on most farms, and there is no reason to think that production will do other than continue to increase. Much depends, however, upon the prices which can be realised in the export market. The value of the cured ground nut hay, which is secured in addition to the crop of nuts, and which forms so valuable a nitrogenous feed for all classes of stock, is an added inducement to growing the crop.

The Farmers' Co-op. have already commenced the export of ground nuts, but are handicapped by the fact that the nuts sent in by members are unshelled. Until recently, the east and west coasts of Africa carried on a large annual export trade in unshelled nuts, but it is understood that this trade is rapidly changing to decorticated or shelled nuts, and that there is now but little demand in Europe for other than shelled nuts. For this reason it behoves farmers and local agricultural implement firms to look around them with a view to obtaining satisfactory ground nut shellers. Shelling the nuts by hand is a very slow and tedious process, and no more is usually hand-picked than is required for seed. Up to the present, ground nut shellers, either of hand or power type, have not proved as satisfactory as was expected. Some of these machines crack as many as 15 per cent. of the kernels in the process of removing the hulls. Enquiries are now being instituted by this Department as to the most popular and efficient shellers in use in the U.S.A., and no doubt our local implement firms are already making similar enquiries. What would appear to be required is a small and comparatively inexpensive hand sheller with a capacity of from 20 bags of shelled nuts a day upwards. Apart from injury by rats and mice, ground nuts can be stored more or less indefinitely in their unshelled condition. Shelling can thus be done at any time when other work on the farm is comparatively slack. A small machine of moderate output will, therefore, in most cases, meet the case, though, if export prices are favourable, the day of the travelling power picker and sheller should not be far distant.

Fat Stock at Johannesburg.—Mr. C. C. Macarthur, of Komani Farm, Salisbury, was the only exhibitor from Rhodesia of fat cattle at the Johannesburg Show. He sent down the five grade Shorthorn oxen which he exhibited at Salisbury and secured the second prize for two slaughter oxen with not more than six teeth, while one of his beasts was highly commended in the class for a slaughter ox with not more than six teeth. We reproduce a photograph of these oxen taken at the Salisbury Show, where they won the special prize of £25 presented by the Salisbury Municipality for the best pen of five oxen on the show, and two firsts in classes for slaughter oxen. These oxen, which were from 2½ to 3 years old, were bred and fed by Mr. Macarthur, and in competing at Johannesburg travelled some thousand odd miles, with a rest of four days only before being judged. In the circumstances

they gave a very good account of themselves, and we congratulate Mr. Macarthur upon the results. Two of the animals were sold for £25 each and two for £22 10s. each. One beast weighed, dressed, 895 lbs.

Wheat.—A movement is on foot to form a limited liability company of wheat growers on co-operative lines with the object of selling, not the grain, but the finished flour, meal, bran and pollard after milling, and of purchasing any foreign flour that may be necessary for the purpose of blending. The intention is to pool the members' wheat and to employ a mill to grind it and prepare all the products at a fixed tariff per bag, the producers sharing amongst themselves the full profits or loss, benefits and risks that may arise. The project was put forward at a meeting of growers during the Salisbury show week, and we understand the proposal is now being considered by a committee then appointed.

The Salisbury Show.—The Salisbury Show is a reflection of the condition of the country, and to-day it is, in regard to maize and tobacco, the biggest show in the southern hemisphere, whilst the quality of these exhibits will bear comparison with any shown in any other part of the world. Until recently this was not so. During the war exhibits and funds alike suffered a severe set-back, as indeed it was only fit and proper that they should do, as all the available men were elsewhere. Even compared to last year there is a noticeable improvement, indicative of the farming activity of the country and the commendable zeal of the Society.

The Rhodesian Agricultural and Horticultural Society is struggling to fulfil its duties to the agricultural industry with means insufficient to cope with the sudden expansion of its interests. This is evidenced by temporary extensions and improvisations in all directions. To equip the grounds for the further extension which is sure to take place next year, and to provide buildings in keeping with the importance of the show, liberal financial support is required and should be forthcoming from those who benefit by the show or are interested in its success.

Flue Curing Tobacco Barns.—We reproduce in this issue plans and specifications of flue curing tobacco barns and packing house. These appeared in the Journal for October, 1919, and are printed again because of the demand for information on the subject. The plans are reproduced without any alteration, as it is considered that the barn illustrated meets the purpose, but the specifications have been slightly amplified. The plans and specifications will be reprinted in bulletin form, and can be obtained free by residents of Southern Rhodesia upon application to the Director of Agriculture, Salisbury.

Rhodesia Land Bank.—The report of the Directors of the Rhodesia Land Bank, Ltd., for the year ended 31st December, 1920, shows that applications for advances during the year numbered 203 for a total of £178,894, against 152 for £114,085 in 1919. The advances made numbered 124 for £78,869, or an average of £636. The profit and loss account shows a credit balance for the year's working of £7,718 9s. 4d., and a total credit balance at 31st December of £13,019 15s. 4d. The loans granted by the Bank to 31st December last numbered 987 for £575,639, and the amount outstanding at that date was £323,866.

Assistant Tobacco and Cotton Expert.—The staff of the Department of Agriculture has been strengthened by the appointment of Mr. D. D. Brown as Assistant Tobacco and Cotton Expert. Prior to coming to Rhodesia, Mr. Brown was manager of the British Central Estates in Nyasaland, and formerly was associated with Mr. H. W. Taylor at the Tobacco and Cotton Experiment Station, Rustenberg, Transvaal. Mr. Brown has entered upon his duties, and his services are now available in an advisory capacity.

Fat Stock Show and Sale.—We would call the attention of farmers who are stall-feeding cattle this season to the substantial prizes offered by Messrs. Shiff & Jacobson at their show and sale of fat stock to be held at Gwelo on 6th December. These prizes consist of £50 for the best pen of six oxen and £25 for the second; £20 for the best pen of two oxen and £10 for the second; £30 for the best pen of 12 veld-fed oxen and £15 for the second; and £10 for the best pen of slaughter cows. For the champion ox exhibited, the Mayor and Deputy Mayor (Councillors H. A. Bradley and J. Antoniadis) have given a floating trophy, value £25, with a cash prize of £5.

Obituary.—Mr. Richard Walsh.—It is with very great regret that we record the death of Mr. Richard Walsh at Bulawayo on the 27th August. His demise, which was very sudden, is a serious loss to the cattle industry of this country, with which he was identified for a number of years in his capacity as General Manager of the British South Africa Co.'s ranches and later as a private individual. Mr. Walsh brought to Rhodesia an exceptional knowledge of the cattle raising industry gained from many years' experience in positions of great responsibility in the United States. This knowledge was always available to those seeking it, and his readiness in this respect, coupled with a charming personality, made the deceased gentleman highly esteemed throughout the Territory. Mr. Walsh had a very high opinion of the natural advantages of Rhodesia as a cattle country, and he had recently taken up land in the Nyamandhlovu district for the purpose of breeding cattle. His death at the present juncture is greatly to be deplored.

The passing of Mr. D. R. Templeton, of Derry Farm, near Salisbury, removes a well known and greatly respected member of the farming community. The late Mr. Templeton took up land some fifteen years ago, and by his industry and practical methods established himself in a very short space of time as a successful farmer. His death, in the prime of life, and when in a position to enjoy the fruits of his labour, is a sad occurrence, and we condole most sincerely with Mrs. Templeton in her bereavement.

A large circle of friends will deplore the death of Mr. Peter Forrestall, which occurred recently. Mr. Forrestall, who was a pioneer, was for many years Native Commissioner of the Chibi area, where, latterly, he had taken up ranching on an extensive scale. The deceased possessed an unrivalled knowledge of the southern portion of the Territory, and probably knew more about the Mashona native than any white man alive. He was one of the best known and popular figures in the Victoria district, and he will be greatly missed.

Green Manuring and Soil Management.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C.,
Chief Chemist, Department of Agriculture.

The successful management of arable land is dependent upon proper attention to several factors, and a brief consideration of the more important of these is necessary in order that the place of green manuring in soil treatment may be kept in true perspective.

A good farmer may be described as one who is not content merely to maintain the fertility of his land at its present level, but who, by wise expenditure of his energy and money, builds up its fertility and recoups himself for that energy and expense by the enhanced crop returns and the increased value of his farm. It is only by such progressive methods that farming, so frequently and rightly described as the backbone of the country, can be established upon a permanent basis.

Subject to the land being satisfactorily drained, which is a fundamental necessity, four dominant factors must receive consideration for the maintenance and improvement of the fertility of soils, viz.:—

- (1) the provision and maintenance in the soil of an adequate supply of humus;
- (2) the addition of plant food in which the soil is deficient;
- (3) thorough tillage;
- (4) the correction of sourness or acidity when necessary in order to promote the growth of beneficial micro-organisms.

As already stated, it is only by giving the necessary attention to all the above factors that the best results can be obtained.

Liming, for example, should be practised only in connection with a system of farming which returns humus to the land, and a fair axiom to follow as a general rule is not to give land a dressing of lime unless, or until, it is well supplied with humus. It has frequently been stated that the application of a dressing of lime has not improved the crop returns from the soil, but it is an unjustifiable deduction to draw that such a soil does not require lime and that lime will not be beneficial if in its use due regard is paid to the several factors limiting the crop return. For successful arable farming *thorough cultivation* is another very important feature in soil management, and experienced farmers will agree that on many farms, one might almost say on the majority of farms where maize is extensively cultivated in this Territory, if the farmers were content to cut down the acreage of land under

harvested crops and adopt more intensive cultivation, the annual output of produce would be maintained, and with the same expenditure of energy and money as is now devoted to the larger acreage, the land would be kept in better heart. *The enrichment of the soil in those elements of plant food in which it is deficient* (chiefly phosphoric oxide in the majority of maize lands) is also necessary to obtain the best crop returns, but in this connection there is another axiom to bear in mind, viz., that it generally pays better to apply fertilisers to good land than to land of low natural fertility. There is no doubt whatever that the practice of selling off practically all the produce of the land in the form of grain without taking steps to return to the land those constituents consumed to obtain that produce is bad farming. If such practice were universal amongst maize growers, it is calculated that one season's output of maize estimated at $1\frac{1}{4}$ million bags would remove from the soil in grain alone upwards of 2,080 tons of nitrogen, 740 tons of phosphoric oxide and 480 tons of potash, whilst the loss of valuable humus it is impossible to estimate. To make good this annual drain upon the plant food supplies of our soils by the application of artificial fertilisers, the following amounts, or their equivalents in other forms of fertiliser, would be required:—

Nitrate of soda	13,300 tons
High grade superphosphate (17.1 per cent.)	4,100 tons
Sulphate of potash (48 per cent.)	1,000 tons
Total	18,400 tons

The total consumption of artificial fertilisers in Rhodesia in 1920 was about 2,400 tons, and of this quantity, which exceeds that of any previous year, the greater proportion was used on the tobacco crop. The above figures serve to indicate what an enormous drain is annually made on the plant food supplies contained in our maize lands, and what a small proportion, even including that put back in the form of farm yard or kraal manure, is annually returned under the existing conditions of farming.

To maintain the fertility of good land and to build up that of poor land, the first essential is to provide and maintain an adequate supply of humus, preferably by rotation of crops, by feeding the crops on the farm and returning the manure to the land, or, as a substitute, by ploughing under green crops, preferably nodule bearing legumes.

The importance of humus in soil fertility lies not only in the fact that it provides food for the soil organisms which everywhere exert so important an influence upon soil fertility, and especially so in countries like ours, where the temperature is more conducive to their active growth, but also in its valuable effect upon the physical condition and water-holding power of the surface soil and in supplying nourishment to plants. One ton of humus will hold two tons of water, and the improved water-holding capacity of land which has been green manured is demonstrated by the extended growing period of succeeding crops, thereby providing more time for the filling of the grain. At the Agricultural Experiment Station, Salisbury, it has been noted that the maize crop following green manure was still green when the crop on the adjoining unmanured plots planted at the same time was ripening off.

The attention of farmers has frequently been drawn to the importance of mixed farming and to the advantages attending the consumption of the produce of the land on the farm. Pending the introduction of mixed farming, the greater consumption of produce on the farm and the return of the manure to the land, the amount of manure produced on the average farm is sufficient only to provide an adequate dressing for a small acreage of the land under cultivation each year. Consequently, to provide an adequate supply of humus in land deficient in this constituent the practice of green manuring must perforce be adopted. In the selection of a green manuring crop discrimination must be used, but, broadly speaking, the crop to be preferred is a nodule bearing legume which produces abundant vegetative growth, and which has been proved a good forerunner of the crops which are to succeed it—an all-important point, because all nodule bearing legumes do not exhibit an equally beneficial effect. In selecting one of the nodule bearing legumes available, account should also be taken of the ease with which the crop can be turned under, and the depth of rooting, as obviously the deeper rooted the crop the more plant food is brought from the sub-soil to become available for succeeding crops whose root range is more restricted.

In order to ascertain the amounts of dry matter, nitrogen, phosphoric oxide and potash contained in crops above ground level, samples of six crops grown in the green manuring trials on red diorite soil at the Agricultural Experiment Station, Salisbury, were obtained for analysis at the time the crops were turned under, and the results of the analyses, which have been carried out by Mr. Flack at the Agricultural Laboratories, are set forth below:—

Weight of crop (dry matter plus water) above ground level when turned under per acre. (Crops planted 2nd and 3rd January and turned under 26th and 27th April, 1920.)

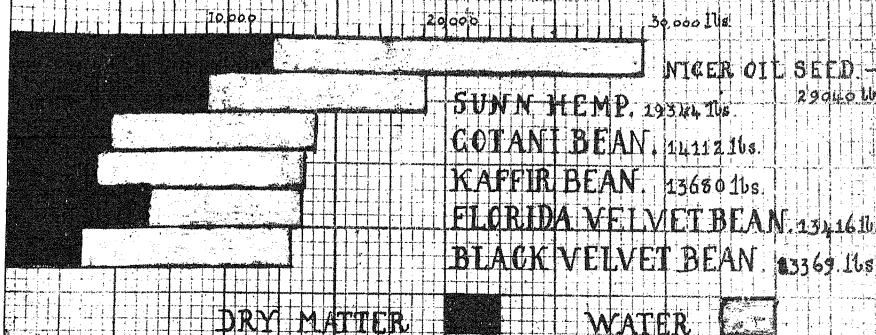
	Dry matter. lbs.	Water lbs.	Total. lbs.
Niger oil seed	11,938	17,102	29,040
Sunn hemp	9,119	10,225	19,344
Gotani bean	4,441	9,671	14,112
Kaffir bean	3,962	9,718	13,680
Florida velvet bean	6,390	7,026	13,416
Black velvet bean	3,298	10,071	13,369

Percentage amounts of nitrogen, phosphoric oxide and potash contained in the dry matter when crop was turned under.

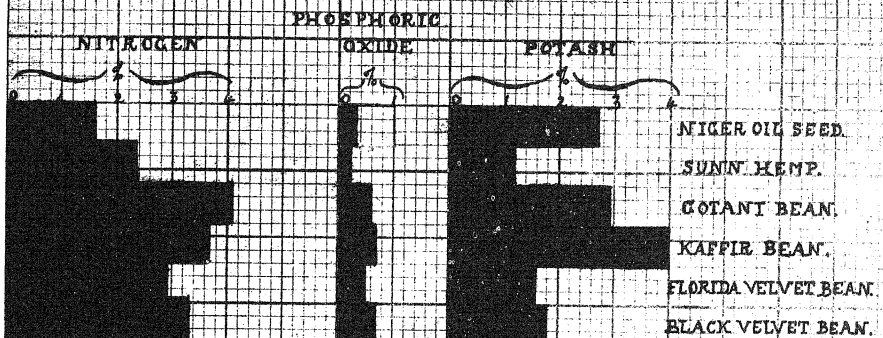
	Nitrogen. per cent.	Phosphoric Oxide. per cent.	Potash. per cent.
Niger oil seed	1.634	.348	2.789
Sunn hemp	2.306	.257	1.262
Gotani bean	4.150	.600	2.987
Kaffir bean	3.788	.642	4.064
Florida velvet bean	2.998	.470	1.696
Black velvet bean	3.345	.653	1.740

Crops Planted 2nd & 3rd January and Turned Under 26th & 27th April, 1920.

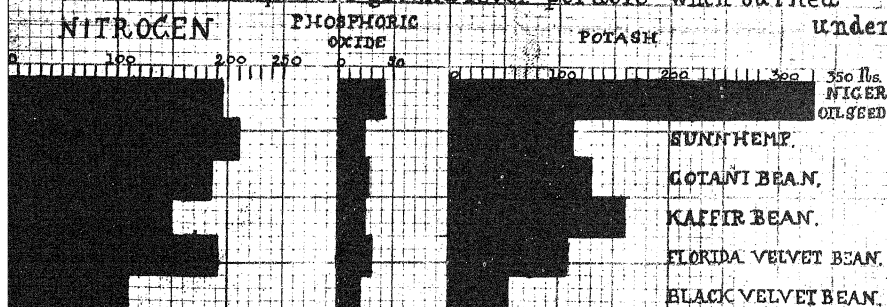
WEIGHT of crops (dry matter & water) above ground level - per acre when turned under



PERCENTAGE AMOUNTS of NITROGEN, PHOSPHORIC OXIDE & POTASH in the dry matter of crop above ground level when turned under



NUMBER of LBS. of NITROGEN, PHOSPHORIC OXIDE, & POTASH contained in crop above ground level - per acre - when turned under



Number of lbs. of nitrogen, phosphoric oxide and potash
contained in crop above ground level when turned
under—per acre.

	Nitrogen.	Phosphoric Oxide.	Potash.
	lbs.	lbs.	lbs.
Niger oil seed	195.1	41.5	333.0
Sunn hemp	210.2	23.4	115.1
Gotani Bean	184.3	26.6	132.6
Kaffir bean	150.0	25.4	161.0
Florida velvet bean	191.5	30.0	108.4
Black velvet bean	110.2	21.5	57.3

It is to be noted that no green manuring crop increases the store of mineral plant food in the soil, although it converts to forms more available as plant food some of that which exists in the soil. Whilst deep-rooted green manuring crops will bring within the range of more shallow-rooted crops some of the phosphoric oxide and potash present in the subsoil, inherent deficiencies in phosphoric oxide and potash are not corrected at all by green manuring, consequently any lack of one or both of these constituents in the soil must be corrected by the direct application of manures containing phosphates or potash as required. The chemical analyses of Rhodesian red soils indicate that they are fairly well supplied in available potash, but that the application of phosphatic manures such as bone meal or superphosphate is necessary from time to time if the crop producing power of the soil is to be maintained or increased.

From the above table it will be noted that the Niger oil crop, which is not a legume, contained in the portion of the crop above ground level over 300 lbs. of potash per acre, whereas the remaining crops, all of which are legumes, contained potash in much smaller quantity. It would, therefore, appear that the supply of available potash in the soil was more than sufficient to meet the needs of the leguminous crops. Assuming that the surface soil over an acre to a depth of 9 inches weighs 2,500,000 lbs., the analyses of samples representing the soil under experiment to a depth of 9 inches showed that it contained 585 lbs. of potash and 45 lbs. of phosphoric oxide soluble in 1 per cent. citric acid solution, this being a solution commonly used to ascertain the amounts of phosphoric oxide and potash present in forms readily available as plant food.

The supply of available potash would appear, therefore, to be sufficient to meet the requirements of crops for the time being, although, owing to the limitations which must be placed on the deductions from the chemical analyses of soils, it does not preclude the possibility that crop returns will be improved by the application of potash manures if used judiciously.

Turning to the content of available phosphoric oxide as revealed by extracting the soil with a 1 per cent. solution of citric acid, it will be seen that the amount in the soil at the time the crops were planted, viz., 45 lbs. per acre to 9 inches depth, would seem to be barely sufficient to provide the quantity present in the crop at the time it was turned

under; consequently, in any scheme of soil treatment for land in which the content of humus is being maintained by green manure, the addition of phosphatic manure is certainly worth trying on an experimental scale.

Nitrogen.—Of all the elements of plant food, the amount of nitrogen in soil is the safest index of its natural fertility, for a low content of nitrogen indicates not only a deficiency in that element, but also a deficiency in humus, and consequently a soil of poor physical condition. As has already been indicated, one of the first essentials for maintaining and building up fertility is to preserve in the soil a good supply of humus. It has also been pointed out that green manuring does not add to the store of phosphoric oxide and potash in the soil, but the selection of an approved nodule bearing legume will enrich the soil not only in humus, but also in nitrogen, which is extracted from the air by the micro-organisms living in the nodules on the roots. It is estimated by some authorities that these micro-organisms absorb from the air two-thirds of the nitrogen present in the plant, and that as about one-third of the nitrogen of the plant is present in the roots, the nitrogen contained in the part of the plant above ground is an index of the amount of nitrogen absorbed by the plant from the air through the agency of these micro-organisms. The growth of nodule bearing guminous crops, therefore, enriches the soil in nitrogen, and the higher proportion of nitrogen in the dry matter of legumes as compared with non-legumes, such as Niger oil, is to be noted.

A study of the table showing the amount and composition of the dry matter above ground level of the crops under trial for green manuring at the Agricultural Experiment Station shows that in 1920 Niger oil seed was the heaviest cropper and gave the largest quantity of dry matter per acre, followed by Sunn hemp, Florida velvet bean and Gotani bean in the order given. Sunn hemp gave the heaviest return of nitrogen per acre, followed closely by Niger oil seed, Florida velvet bean and Gotani bean. By some it may be considered that Niger oil seed, in view of the fact that it yielded a larger quantity of dry matter per acre and almost as much nitrogen as any of the other crops under trial, stands out to advantage as a green manuring crop when compared with Florida velvet bean and Sunn hemp; on the other hand, bearing in mind (1) the difficulty of ploughing under efficiently so heavy a crop as that returned by Niger oil seed, (2) that the nitrogen content of the crop above ground level in the case of nodule bearing legumes is estimated more or less to be a clear gain to the soil, (3) that the humus produced from a legume crop is richer in nitrogen than that produced from a non-legume, and (4) that a heavy crop of Niger oil, yielding 1,900 lbs. of dry matter per acre, may not always be obtained, the advantage as green manuring crops, even in these experiments, would appear to rest with the legumes, Florida velvet bean and Sunn hemp, until there is more definite evidence available concerning the relative green manuring values of these crops.

The Time of Ploughing under Green Manuring Crops.—After having grown the green manuring crop, it is very important that it

should be properly incorporated with the soil before the land has dried out, in order that the vegetable matter may decompose before the succeeding crop is planted.

If a mass of undecomposed vegetation is present in the surface soil when a crop is planted, the surface soil is opened up to such an extent as to be liable to dry out quickly, with the result that the young plants may experience a set-back at a time when they are least able to withstand it. Furthermore, in the anærobic decomposition of vegetable matter substances toxic to plants are produced in the early stages. Where undecomposed vegetable matter is present in large quantity in a soil and the drainage conditions are inefficient, the accumulation of toxins may be sufficient to seriously reduce the yield of the following crop. That such toxins are produced during the early stages of decomposition of vegetable matter has been proved by experiments conducted at Pusa (India) in 1913 by Hutchinson and Milligan. In these experiments green manure buried in wet rice soil produced decided toxic effects on rice seedlings when the latter were transplanted during the initial stages of decomposition. Seedlings transplanted in the soil after the green manure had undergone decomposition showed decided improvement in growth over controls in unmanured soil, and still more so when compared with those exposed to the toxic action of the green manure during the initial stages of decomposition.

The above observations are recorded in order to indicate the importance of turning under a green manuring crop whilst the land is still moist, in order to ensure the decomposition of the vegetable matter before the succeeding crop is planted.

Soil Washing.

By A. C. JENNINGS, Assoc. Mem. Inst. C.E., Government Irrigation Engineer.

With the approach of the wet season it will not be out of place to deal briefly with this subject, which concerns almost everyone engaged in agriculture in this country. It is one of the most important problems that faces the farmer to-day, and unless seriously taken in hand will lead to the ultimate ruination of many of the best tracts of arable land, which unfortunately are all too scarce in the country.

The majority of people fail to realise that good soil is a national asset; in fact the greatest asset a country possesses. It behoves everyone to see that this asset is preserved and not dissipated as is occurring to-day. There is probably no other subject upon which so much has been written during the past 25 years in South Africa. Many people will possibly express some doubt as to whether we are troubled much in Rhodesia with erosion, and judging by the less visible effects one sees here compared to some parts of South Africa, there might be some justification for the doubt thus expressed. Upon closer examination of the subject, however, we shall undoubtedly find that erosion, described better perhaps as the washing of cultivated lands, is taking place here to a very considerable extent.

True it is, perhaps, that it is occurring in a very insidious way, but nevertheless the trouble is there, and unfortunately its effects are cumulative. Erosion might be classified under two main heads:—(a) natural erosion, and (b) erosion due to artificial causes. By natural erosion is meant the process whereby the earth's surface is continually changing to a greater or lesser degree. The weathering of rocks due to climatic and other actions, and the transportation of minute particles by the wind, all go to make up a process of denudation which has been going on since the earth was created, and will no doubt continue to do so. The artificial or biotic causes of erosion are those due principally to human and animal influences, which occur on the earth's surface. Of these the visible evidences are seen in:—

The creation of dongas.

The scouring and deepening of river beds.

Desiccation of areas which were formerly fertile.

The retrogression of vegetable life, notably in the grasses.

The washing of arable land.

It would be possible to write a separate paper on almost any one of these matters, and no doubt each would be of very considerable interest, but it is only proposed here to deal with the more specialised form of erosion known as soil washing, in its relation to arable land.

Creation of Soils.—A large part of the earth's surface is covered to a greater or lesser extent with soil, which is derived from the disintegration of rocks. In some cases the soil is typical of the underlying rock from which it is derived, while in other cases it may have been produced from a distant rock and transported to its present situation by the action of wind and water.

In the process of time, vegetation is established and organic matter helps to make up the complex structure of an average sample of soil. The soil-cover generally throughout Southern Rhodesia is thin, and the absence of deep alluvial soils such as one finds in river valleys or deltas of large rivers in other countries is particularly noticeable. Almost one-half of the total area of the country is granite formation, and the granite soils in a large part of the area do not exceed two or three feet in depth. The remaining portions of the total area come under the general classification of schists, sandstones and basalts. It is from the former that our rich, red, fertile soils are principally derived, and the sand areas of western Matabeleland from the latter two, these soils being generally deeper than in the granite areas.

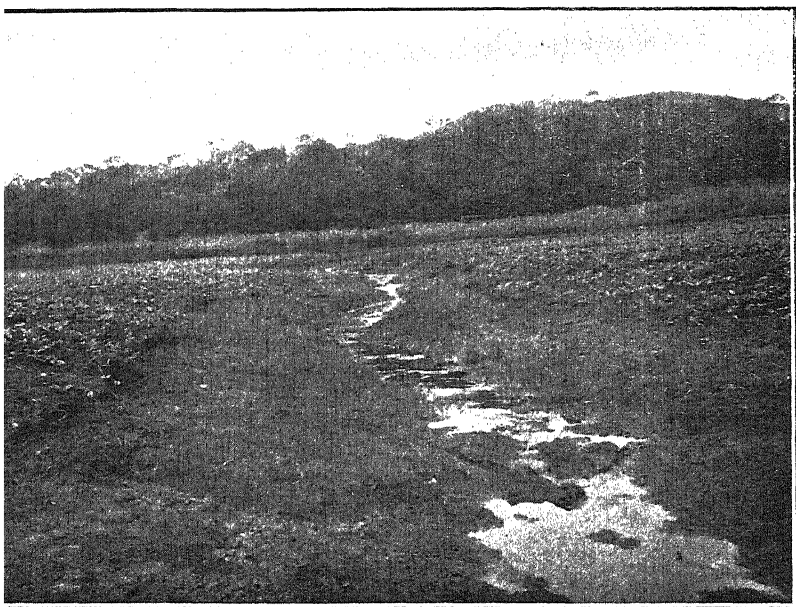
A certain author has said that "It takes more centuries than there are hairs on your head to make a good soil," and this is very true. The fact remains that the creation of soils is an exceptionally slow process, and when one considers that a few seasons' floods can destroy and carry away beyond recovery the production of thousands of years of nature's work, the need for soil preservation will be at once appreciated. It is possible that a small percentage of the soil washed from lands in the higher reaches of a river is deposited in the lower reaches, but by far the largest percentage is carried in suspension by the rivers to the sea and is irretrievably lost.

Conditions in Mashonaland.—A good deal that has been written on the subject of soil erosion in South Africa refers principally to Karroo conditions. In Mashonaland and a large part of Rhodesia the conditions are very different. In the first place it must be realised that we are living between latitudes 15 degrees and 22 degrees south of the equator, and that this is actually a sub-tropical country with a semi-humid climate which differs very greatly from the semi-arid conditions of the Karroo. There are few parts of the country where the average annual rainfall is less than 20 inches, and the normal average for Mashonaland is nearer 30 inches. This rain all occurs in the summer months, October to March, and the warm humid conditions of the summer season favour a dense luxurious growth of grass and vegetation.

A stranger from Europe coming to this country during the summer and seeing the whole veld clothed in green grass would not realise at first that he was in a sub-tropical country. All this dense vegetation and bush affords a natural clothing for the soil, and it is nature's provision against erosion. It may be said that one can traverse almost



Example of erosion which occurred in one night.



Sluit formed through land owing to no provision being made to carry off storm water at top of lands.

any piece of unoccupied country where human agencies have not been at work and find very little evidences of soil washing or donga formation. It is only when man comes in and commences his so-called work of civilisation, such as clearing bush, burning the grass and making roads, that the trouble commences.

In general it may be said that so far we have not suffered a great deal in the matter of general veld erosion, or at least to anything like the same extent as has occurred in many parts of the south. One certainly does not here see the huge gaping dongas and sluits intersecting the veld in all directions. It is not proposed, therefore, to deal very deeply with this aspect of the subject. It is necessary, however, to sound a warning note so that we may not be lulled into a sense of false security. In spite of the dense vegetation which admittedly provides an excellent natural cover, we must remember that the rainfall here is at times exceedingly intense and precipitations equal to 3 inches per hour are not uncommon.

In chopping down bush, burning veld, making roads and railways, and in driving stock continually on the same path we are paving the way for future trouble unless proper safeguards are observed and precautions taken. As an example of how easily soil can be displaced and carried away may be mentioned a small case that came to the writer's notice a short while ago. In taking levels on two old tennis courts it was found that there was a fall of over seven inches from one end to the other, although an assurance was given that about five years ago when these courts were laid down they were practically level. Now if this amount of soil can be carried away from a comparatively level surface, it can be conceived how easily the soil of unprotected sloping land can be affected. Just observe on any wet day the discolouration of the water running down roadside gullies, and to satisfy yourselves, take a sample of the water and allow it to settle in a glass: you will soon see the large volume of silt carried in suspension; and all this silt is washed from the surface of the land.

The following are a few figures extracted from a bulletin by Mr. Torrance, of the Grootfontein School of Agriculture, giving the silt contents of samples taken from some rivers in the Cape:—

	Samples analysed.	Solids in suspension. Grams per 100,000 c.c.
Thebus River	14	2113.4
Little Brak River	14	1776.5
Vetfontein River	2	3275.00
Fish River	2	1199.00

In the case of the Vetfontein River there were found $3\frac{1}{4}$ kilograms of solid matter in every $1/10$ cubic metre of water, or 7 lbs. in every 22 gallons.

A chemical analysis made of the silt extracted from a muddy water flowing from an uncultivated area after a 3-hours rain was found to contain—

Phosphoric oxide	0.15 per cent.
Potash	0.990 per cent.
Lime	0.170 per cent.

Thus it will be seen that in losing the surface soil one also loses a very considerable proportion of the chemical contents of the soil which are so essential to the support of plant growth. There appears to be little information available of the silt carried by the rivers of this country when in flood. From general observations it would appear that the silt is very much less than that of many of the Karroo rivers, but all the same, it is of some concern even with us here.

Washing of Cultivated Lands.—All this leads up to the main question, and that is the washing of the soil from cultivated land. It has been seen how easily soil can be displaced even under favourable conditions when it is protected by its natural cover, and the land is comparatively level. Now consider for one moment the conditions of the greater part of the red maize lands in this country. In the first place there is very little truly flat land; and as a general rule the land has a fairly steep slope. In the Mazoe Valley in particular the best lands are situated fairly close up under the hills and have in consequence a steep slope between the hills and the river. This slope often varies from 1 to 10 per cent., that is up to 10 feet in every 100 feet. Now a farmer takes up new land, and naturally his first concern is the production of crops. He selects a piece of land and prepares it for cultivation by chopping down all the bush, ploughing in the grass and generally making the area as clean as possible previous to planting. All this is, no doubt, very right and proper, and our agricultural friends will compliment him upon the manner in which he has cleared up his land and brought it into a condition of good tilth. Having removed nature's cover, and perhaps planted mealies, the land is in just the right condition to be easily damaged when the opportunity occurs. In the first few years, especially if the rainfall is not too heavy, there is often little evidence of much being amiss, but suddenly there comes an abnormal season such as 1917-18, with most unusual precipitation and intensities, and the soil is literally washed away wholesale. Fortunately much of the red soil in the maize belt is fairly deep, and the land even after severe washing is still able to produce crops; but it must be remembered that every particle removed from the surface not only carries away the best soil containing the humus and a large part of the plant food, but brings the sub-soil nearer the surface.

Now this is precisely what is happening in this Territory, and if steps are not taken to check the evil, then it will take a very few years in many cases to reduce the land to such a state of infertility that the best farming methods in the world will not correct it. There are a large number of farms, excellent maize farms, where very great damage has already occurred and will in many cases continue to occur unless the problem is seriously tackled. The writer has seen pieces of splendid land literally ruined in one year, that is the whole surface soil washed away right down to the sub-soil beyond recovery.

Soil washing occurs in at least two ways: first there is the water that actually falls on the land in the form of rain and has to get away somewhere; then there is the water that runs on to lands from adjacent hillsides. Now the latter is largely preventable, and this

will be dealt with first. When new land is being broken, the common practice is to clear away everything and plough it up in one clean block, which in a way is very estimable; but provision is seldom made for the passage of storm water over that land from the adjacent upper lands or hillsides. In the natural state of the land this water would spread itself over the surface and gradually find its way into the watercourses and rivers, the banks of which are normally well protected with bush and vegetation.

Precautionary Measures.—Wherever possible, therefore, all lands which are so situated as to receive the run off from adjacent hillsides should be protected by sufficient and suitable storm water drains. These should be laid out and aligned in a proper manner along the upper edge of the land, and suitably graded so that they will not scour their beds. The location of such drains is not always an easy matter, and in many cases professional advice should be sought in regard to their construction. It is most important that the grade of such drains is not too steep, as otherwise they in turn will scour. The eroding power of water in motion varies approximately as the square of velocity, thus water running at 3 feet per second will have twice the power to erode than if the velocity were 2 feet per second. Where the drains are cut through hard materials such as compact gravel or rock, steep grades and velocities up to 5 or 6 feet per second can be adopted, but where constructed in soft ground the grade should not usually exceed 1 in 500, and the velocity not above 3 feet per second. In many cases drops will have to be provided in these drains, and where such are necessary they should be built substantially in masonry or of one of the semi-permanent forms of construction described later. The size of such drains will naturally vary with the estimated volumes they will be called upon to carry; the latter can only be determined by an estimation of the run off likely to occur from a given catchment area with a precipitation of unusual intensity. It is of course impractical and almost impossible to design drains and similar structures that will be safe against extreme conditions such as cloud bursts, but in most cases they can be made safe for all reasonable requirements. In recent years we have seen considerable damage done by railway culverts and bridges being washed out, and one can safely say that such incidents would have been largely avoided if more precise data of rainfall and hydrographic conditions had been available when the railways were built. In this connection might be mentioned the valuable work which is being performed by the Government Hydrographic branch, and if funds are available it is hoped in a few years to obtain a large amount of valuable data.

The question of grass burning is often referred to, but it must be realised what a difficult matter it is for the land owner always to prevent this happening. In spite of this, however, every care and precaution should be taken to preserve and protect the grass and bush along hillsides and on veld situated above cultivated lands. It is here where such protection is most badly needed to check excessive and harmful run off.

Considering further the matter of catch water drains, it may not always be possible to pick up and divert all storm water which would

naturally pass down, over or through the lands. In such cases consideration must be given to the original drainage lines which naturally intersected the land. It is a common practice in preparing land to plough up huge areas entirely regardless of the natural depressions which formerly served as drainage channels during the wet season. This practice is entirely wrong and should be stopped at once. The moment these water courses are ploughed, erosion starts and a large donga is formed, which accelerates surface wash for a considerable distance upon either side. It is usually only when these things begin to occur that the land owner commences to worry about erosion, and then seeks advice upon how to correct it. On no account, therefore, should any natural watercourse which intersects a ploughed land be cleared and ploughed unless suitable provision for carrying off the storm water has been provided. They should be left as far as possible in their original condition and no ploughing permitted within a fair distance of their top edges. Of course this will entail the working of the land in smaller blocks, so that instead of ploughing up large areas indiscriminately, the fields will be smaller. No doubt this has its drawbacks, but then it must be regarded in the light of being the lesser of the two evils. In cases where drainage courses have already been ploughed and erosion has started, it is advisable to throw these out of cultivation and allow them to become covered with natural growth, or plant artificial trees such as poplars along their courses.

Assuming that all extraneous storm water has been intercepted, the next problem is that of the rain which actually falls on the cultivated lands. If the rain falls as light showers and the land is still fairly absorptive, a very large percentage enters the ground and drains away in the sub-soil. If, however, as happens sometimes during January and February—usually our months of heaviest rainfall—the ground is already saturated and a very heavy shower occurs, then a very considerable percentage runs off the land. This water will flow down in small trickles possibly along the cultivation lines and finally grow into a large torrent before perhaps reaching a natural gully or stream. It is necessary now to take care of this water and carry it away in such a manner that it will do least harm. If conditions are favourable, drains can be located at intervals through the land and carried along the contours and discharged at some convenient point. These drains will require careful watching during the rainy season and kept free from silt and debris. Another method, and one perhaps more to be recommended, is to leave contour belts of unploughed land which will act as checks and prevent any general scour from the top to the bottom of the land. These belts will be grass covered and will tend to hold up any silt which becomes washed from the adjacent upper cultivated land. The leaving of these unploughed strips means of course smaller lands, but here again it is the lesser of two evils. On sloping land, rowed crops such as maize should generally be planted with their rows along the slope; but this without other safeguards is insufficient to prevent scouring and sluiting.

Another and perhaps the best method of all is to adopt some system of ridging or terracing. It may admittedly be a fairly costly operation, but then if it will ensure complete and permanent protection

of the land it will justify a reasonable outlay. This system consists of laying off at intervals down the slope of the land a series of broad base ridges which are constructed approximately along contour lines. The distance apart of these ridges will be determined by the slope of the land, but in general they should be located at about every six feet drop in the slope. These ridges which form a series of terrace lines should have a gentle falling slope in one direction, so that all water which does not soak into the ground can flow away gently to the lower end, where it will be taken care of in a suitable manner. A very strong argument in favour of this system is that by preventing rapid run off, a very much larger percentage of the rain which falls soaks into the ground and by deep percolation is stored up and becomes available during the dry spells which so often occur during our rainy season. In constructing these ridges, the first operation will be to lay off the grade line upon which the terrace is to be constructed. Taking this line as the centre of the completed terrace, a strip will be ploughed and back furrowed about 20 feet wide. The upper half of this strip will be scraped towards the centre to form the ridge, and the lower half gradually worked up to the ridge by back furrowing. The work must be well done and care taken that the top of the ridges are uniformly level without any dips or hollows. These terraces with their broad bases form very little obstruction in the lands, as all farm implements, including ploughs, planters and cultivators, can pass over them without difficulty. Once the terraces are properly formed, it is preferable to plant up and down the slopes and not along the contours. In laying out lands on this system it would be preferable to secure professional assistance in regard to fixing the grade lines of the terraces, as this is one of the most important items in their construction. The system is regarded as one of the only real methods of checking soil washing and retaining and preserving the soil.

As a practical case of the destruction caused by the soil washing, the abandonment of native lands in the native reserves is about the best example. These lands, being mostly on shallow granite soils, soon become affected by a few seasons' heavy rains, and as land to-day is fairly plentiful, the native, as soon as he sees them becoming impoverished, simply moves on and starts a new piece. This state of affairs is very different to that adopted by the people who once occupied the eastern areas of this country in the Makoni and Inyanga districts. Here one sees the remains to-day of hillsides terraced from the top to bottom where every particle of soil must have been held in place, and hills almost devoid of soil were undoubtedly made to produce crops.

It is proposed to touch upon a few of the methods of checking erosion in dongas where considerable damage has already occurred. The first step towards correction and prevention of further scouring is to encourage the natural growth of vegetation on the sides and bottom of the sluit. As a temporary expedient, large bushes can be cut down and placed in the sluit with their crowns upstream. These help to collect silt and keep conditions in equilibrium until more permanent work can be carried out. A useful form of protection in small sluits is to drive a row of good hard poles in a line across the bed leaving

their tops about 9 inches above the ground. These poles can be interlaced with pliable sticks or galvanised wires and form a barrier which will prevent further washing and hold up silt and debris. A number of such barriers at frequent intervals along a slit create a series of drops, and by increasing their number always at a slightly higher level than the previous, a general correction is obtained and the bed restored to its former level. The planting of suitable trees along the sides of such eroded dongas should proceed hand in hand with other protection work, and will largely assist in maintaining stable conditions.

What is usually called boulder net work is perhaps one of the cheapest and most effective types of semi-permanent protection work. By semi-permanent is meant any type of construction other than solid built concrete or masonry work, which of course in many cases is out of the question, on account of its cost. The boulder nets are used as barriers or obstructions in river beds or dongas and are able to withstand large floods passing over them without much harm. Should they settle or become displaced, they are easily repaired or straightened. The net work consists of long lengths of specially woven wire netting made up of No. 6 or No. 8 wire on about a 6-inch mesh. These lengths of netting can be made from 6 to 12 feet wide and are first laid down flat and the boulders laid into position on same. The net is then folded up and secured so that the boulders are totally enclosed in a wire net in the form of a bolster or sausage. Such work is also most effective in building and retaining road drifts, and will if used prevent the wasteful methods of placing loose stones on the lower sides of drifts which become washed out every wet season.

In conclusion it must be emphasised that it is impossible to generalise on the preventive methods to be adopted to impede or prevent erosion. Nearly every case requires individual consideration and treatment, and the best plan is to seek skilled advice before starting on work of any magnitude. It is hoped that these few notes will stimulate interest so that our soils, which after all are a natural heritage, shall be preserved in every possible way.

The Interdependence of Crop Rotation and Mixed Farming.

An error occurred in the diagram headed "Stock Farming Most Profitable," which appeared in the last issue of this Journal. The crops in the order they appear should be: Corn, oats, clover.

Milk Records and Milk Testing.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

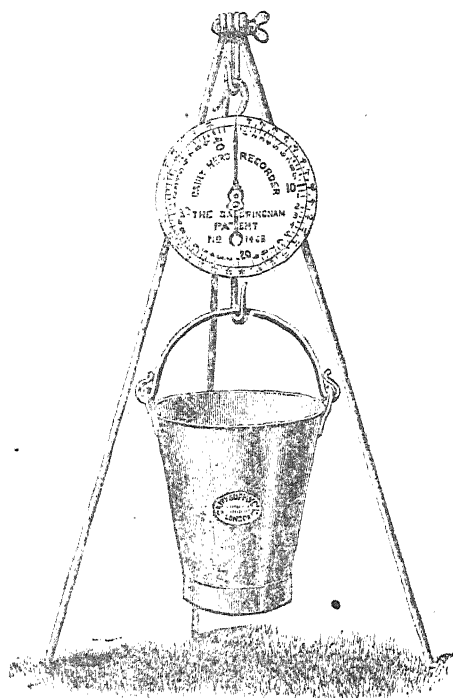
The number of cows and heifers over one year old in Southern Rhodesia, according to figures published in the August number of the *Rhodesia Agricultural Journal*, is 365,835. The greater number of these are of course ranching cattle or native-owned cattle. If we assume that one-tenth of these are milked, the number producing milk may be estimated at 36,000. These animals are credited with producing 618,584 lbs. cream, 244,761 lbs. butter, 2,655,190 lbs. milk. We can calculate the quantity of milk represented by the cream and butter if we assume (1) that the cream contains 40 per cent. butter fat; (2) that 3.5 lbs. of butter fat are obtained from 100 lbs. of milk; (3) that it takes 25 lbs. of milk to make one pound of butter. The cream is estimated to be produced from 7,070,000 lbs. of milk, whilst the amount of butter (244,761 lbs.) is produced from approximately 6,200,000 lbs. of milk. The total production of milk is therefore (in round numbers) 15,925,000 lbs. A gallon of milk weighs 10 lbs., so that our 36,000 cows produce a million and a half gallons, or approximately 44 gallons per head per annum.

The Australian average milk production is 280 gallons per cow per annum, and even this is low when compared with the average yield in Denmark of 750 gallons per cow. It should be the object of every dairy farmer in this Territory to raise the milk production of his herd to a figure which will place Rhodesia in the forefront of the dairy countries of the world. This can only be done (a) by the better treatment of dairy stock, (b) by the use of pure-bred dairy bulls, and (c) by selection and the weeding out of unprofitable stock. No better scheme for the achievement of this latter end has been introduced than the system of milk recording, or cow testing, as it often is called. The first association was founded in Denmark so lately as 1895, and the system has spread to all dairy countries, and although sparse population and long distances prevent us in Rhodesia from introducing highly developed schemes of milk recording such as obtain in Denmark, England and the United States, yet we can make a beginning with a scheme, which, although not official, will be under the supervision and control of the Department of Agriculture.

The scale, either in the case of the beef breeds or the dairy breeds, is the infallible judge as to the merits of an animal. Cattle are bred to function as good producers whether measured by the standard of the block or the bucket, and thus the importance of exact knowledge of the production of each dairy cow is obvious.

The milk recording scheme, which it is hoped will be well supported in Rhodesia, is as follows:—Application for entry forms should be made to the Dairy Expert, Department of Agriculture, Salisbury.

These entry forms (one for each cow), of which the following is a facsimile, should be filled in and forwarded to the Dairy Expert, Department of Agriculture, Southern Rhodesia.



An infallible means of judging a dairy cow.

MILK RECORD.

Application Form.

Breed..... Ear No. (if any).....
 Name.....
 Date of birth.....
 Colour and markings (diagram on back to be filled in).....
 Date of last calving..... Commenced record.....
 Sire..... Herd Book..... No..... Vol..... Page.....
 Dam..... Herd Book..... No..... Vol..... Page.....

Owner's Declaration.—I hereby declare that the pedigree and particulars entered above are correct.

Signature of owner.....
 Address.....

As witness:..... Date.....

In its simplest form milk recording means the registering of the weight of milk produced by the cow, and although daily weighings are always advisable, yet for the purpose of this test weekly weighings are advised as being the more practical. One day in the week, *e.g.*, Sunday, should be set aside for this work, as it is essential that the weighing should be regularly carried out once every seven days. Returns of the weights of milk must be sent in every 28 days on a form made out as follows:—

Weekly Weighings and Butter Fat Return.

Owner's name.....
Address.....
Name of cow..... Breed.....
Date of birth..... Commenced record.....

[illegible]

I certify that these weights have been registered by me and are correct.

Owner's signature..... Recorder.....
(if other than owner)
Date.....

Testing for Butter Fat.—The butter fat content of the milk produced by each cow is of extreme importance in a country where the butter making industry is developing rapidly. It is well known that the tendency to produce a high percentage of butter fat runs in families of dairy cattle. It is therefore essential to breed from a bull whose dam has been a high producer of milk and butter fat, so that this tendency can be transmitted to the offspring. The testing for butter fat is not so simple as the weighing of the milk, but the adoption of the butter fat test will make the milk records all the more valuable. It is to be hoped, therefore, that it will be adopted in the majority of cows entered for the test. There are two recognised methods of testing: (a) The Babcock method, (b) the Gerber method.

The Babcock Test.—The apparatus required to carry out the test for butter fat by this method consists of the following:—

- (1) The tester—a centrifugal machine fitted with swinging pockets to carry the test bottles. This machine is worked by hand power.

- (2) Milk test bottles. These glass bottles are about 50 cc. capacity, and the neck is graduated in 1 per cent. divisions each, subdivided to 0.2 of 1 per cent.
- (3) A milk pipette measuring 17.6 cc. of milk for delivery to the test bottles.
- (4) An acid measure to measure 17.5 cc. of sulphuric acid of a specific gravity of 1.82.
- (5) An ordinary dairy thermometer graduated to 212 deg. Fahr.
- (6) A good supply of hot water of a temperature between 170 degrees and 180 degrees.
- (7) Spiral brushes and washing soda to cleanse the glassware.

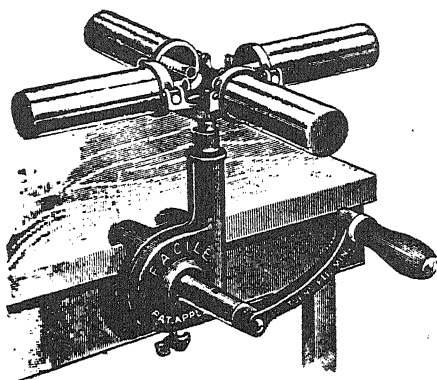
Obtaining a Sample of Milk for Testing.—The milk from each individual cow tested for butter fat must be a fair representative sample and of an even consistency. To obtain such a sample it is essential to pour the milk several times from one bucket to another after the milk has been weighed. In this way the milk is mixed well, and a representative sample is placed in a small, wide mouthed glass or earthenware jar labelled with the name or number of the cow. By the time that all the samples have been obtained and the testing has begun, the cream will have risen. To obtain a sample of even consistency, the milk must again be poured three or four times from jar to jar in order to mix it thoroughly.

Measuring the Milk for Testing.—Stir the milk with the end of the 17.6 cc. pipette and draw up the milk into the pipette. When using a new or clean pipette it is advisable to draw up the milk once and allow it to flow back to the vessel. This wets the glass thoroughly and allows of a more representative sample being obtained. Sometimes the glass may have a coating of moisture, which when returned to the bulk of the sample will not affect the test, but might do so if retained with such a small quantity as 17.6 cc. Place the first finger over the end of the pipette and release it gradually so that the milk runs down the pipette until the bottom of the meniscus rests exactly on the mark. The milk is then transferred to the test bottle. It should be noted that the bottle must be held obliquely so that the milk can run down the side of the neck of the bottle. If held vertically the narrow neck of the test bottle is apt to be choked and the milk to be spilt. When all the milk has been transferred from the pipette to the test bottle, the acid can be added.

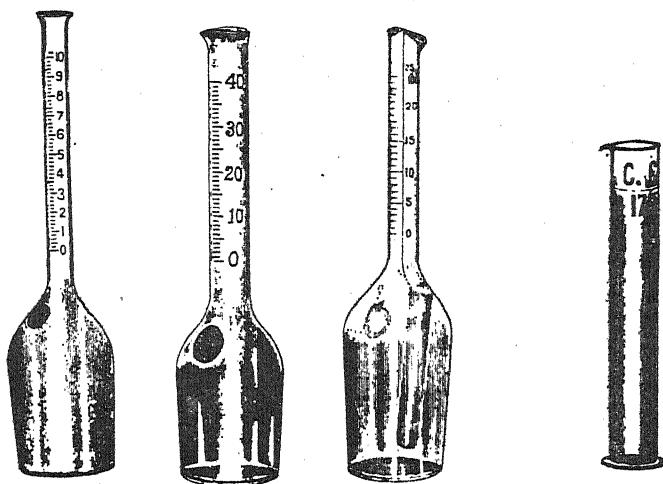
Adding the Acid.—Measure out 17.5 ccs. of sulphuric acid of the correct strength (specific gravity 1.83) in the measure provided in the testing outfit, and holding the bottle (containing the milk already measured out) obliquely, pour the acid slowly down the neck of the test bottle. When all the acid has been added the acid and the milk should be in distinct layers—the acid, being heavier, lying underneath the milk.

Mixing the Milk and Acid.—Take the neck of the bottle between the finger and thumb, and, holding the top of the bottle, rotate it for a minute or more until the milk and the acid are thoroughly mixed. Heat will be generated and the colour will gradually become a dark

purplish black. The other bottle, having been prepared in the same way, is placed in the opposite pocket of the machine. (If a four-bottle machine is used four samples can be prepared in the same way, but it is obvious that the machine must be balanced by having two, four or six bottles distributed evenly.)



The Babcock centrifuge, 4-bottle size.



Milk and cream test bottles for Babcock machine.

17.5 cc. acid measure
for Babcock test.

Whirling the Sample.—Turn the handle of the machine slowly at first, working up to the rate of turning indicated on the handle of the machine. The pockets containing the bottles will fly out horizontally. Turn for at least three minutes.

Adding Hot Water.—Add hot water (at a temperature of 170 degrees) with the pipette until the bottle is filled just to the base of

the neck. Rotate rapidly for another minute and add hot water until the fat column rises about three parts up the graduated portion of the neck. Rotate again for another minute, and, removing the bottle from the pocket, place it in hot water for a minute. Read the height of the fat column from the bottom of the column up to the middle of the meniscus at the top. The reading can be more easily registered by the use of a pair of dividers.

Cleaning the Bottles.—The bottles are then shaken and emptied, and then washed out with hot water in which washing soda has been dissolved. A spiral brush is often used, but if emptied whilst the solution of milk and acid is still hot, the bottles are usually cleaned enough by rinsing out with hot soda water.

Unsatisfactory Tests.—*Burnt, dirty or cloudy tests will result—*

- (1) If the acid is too strong. This being the case, instead of having a clear yellowish column of butter fat, it will be burnt and blackish. The obvious thing to remedy this is to use less acid than 17.5 ccs. or to dilute the acid.
- (2) If the temperature of either the acid or the milk is too high. The temperature of each should be 70 degrees F.
- (3) If the acid falls directly on to the milk and chars it. In pouring the acid into the bottle it is necessary to pour the acid slowly down the neck so that it settles underneath the milk without burning it.
- (4) If too much acid is used. The remedy for this is obvious.
- (5) If the mixing of the milk and acid are long delayed. If a four-bottle tester is used the bottles should be prepared and shaken just prior to whirling the machine.

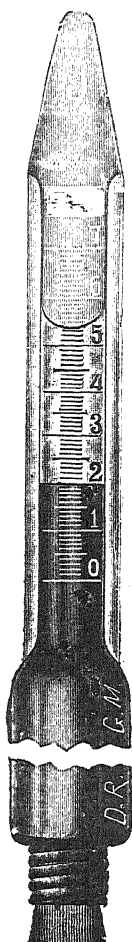
Pale-coloured tests and tests showing particles of curd will result—

- (1) If the acid is too weak.
- (2) If less acid of the proper strength is used than 17.5 ccs.
- (3) If the acid and the milk are at too low a temperature.
- (4) If the mixing is not thorough or if the bottles are not shaken long enough before being put into the machine.

The perfect test should be of a clear amber colour throughout, showing no trace of curdy matter or burnt particles of fat.

The Gerber Method.—This method of testing milk is similar in principle to the Babcock method. It differs, however, in that (1) the bottles are of different shape; (2) rubber stoppers are used; (3) amyl alcohol is used to give a clear reading; (4) different quantities of milk and acid are used; (5) a slightly different machine is used, but it is based on the same principle, i.e., the development of centrifugal force; (6) a slightly weaker acid of a specific gravity of 1.82 is used; (7) only one whirling is necessary instead of three, as in the Babcock test. The advantages to be derived from the use of the Gerber system are that a clear reading is obtained, which by adjusting the fat column by means of the rubber stopper can be read without difficulty; and that its use is more economical in acid and milk, as lesser quantities are used in testing. The apparatus consists of the following:—

- (1) Milk testing bottle, usually graduated up to 7 per cent. and each of these graduations sub-divided to show 0.1 of 1 per cent.
- (2) Three pipettes, one of 11 cc. for milk, one of 1 cc. for amyl alcohol and one of 10 cc. for sulphuric acid.



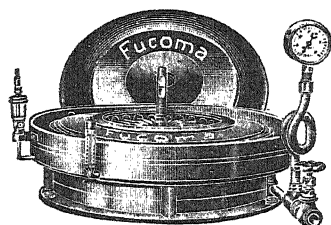
Gerber test bottle with rubber stopper, showing fat columns of 8.3 per cent. butter fat.



10 cc. acid pipette for Gerber test.



11 cc. milk pipette for Gerber test.

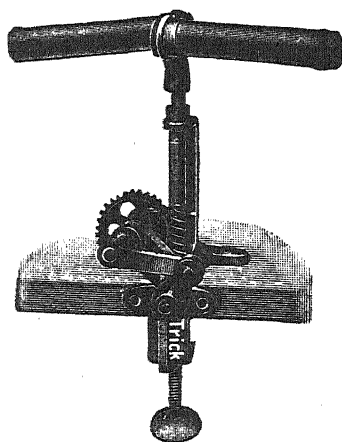


Steam turbine Gerber tester, to hold 36 samples of milk.

- (3) Wooden rack for holding glass ware.
- (4) Tin bath for holding hot water and a spirit lamp for heating same.
- (5) Sulphuric acid of a specific gravity of 1.82.
- (6) Amyl alcohol.

Method of Conducting the Test.—Obtain a consistent sample of milk as described in obtaining a sample for testing under the Babcock method. The milk should be at a temperature of 70 degrees F.

- (1) Measure with the pipette 10 ccs. of sulphuric acid and place in the testing bottle. Do not allow the sulphuric acid to touch the neck of the bottle. If it does, the rubber stopper will not hold.
- (2) Measure out 11 ccs. of milk with the pipette and let it run slowly from the pipette on to the acid. If the milk is allowed to run too freely on to the acid, the sample may be charred.
- (3) Measure out 1 cc. of amyl alcohol and place this in the test bottle on the top of the milk.



The Gerber hand testing machine.

- (4) Screw the rubber stopper in the neck of the test bottle until about an eighth of an inch extends below the bottom of the neck.
- (5) Shake the test bottle well, keeping the thumb on the stopper in order to keep it in place.
- (6) When all the milk in the top of the test bottle seems to have been dissolved, turn the bottle upside down and then reverse it two or three times.
- (7) Place the bottle in the centrifugal machine and whirl for three minutes at a speed of about 1,000 revolutions per minute.
- (8) Remove the bottle from the machine and place in a rack standing in hot water at a temperature of about 150 degrees for at least two minutes.

Taking the Reading.—Hold the test bottle upright in the left hand towards a good light and turn the rubber stopper until the bottom of the fat column stands on zero or on one of the percentage marks of the graduations. Then read the percentage of butter fat from the bottom of the fat column to the bottom of the meniscus at the top.

Monthly Tests.—It is obvious that it is not practical to take tests for butter fat every day or even every week, but it is essential that a test over two consecutive milkings be taken every month. The average percentage butter fat test will serve as a basis on which to calculate the total production of butter fat for the 28 days.

The form of return for butter fat returns should be as follows:—

Monthly Butter Fat Test.

Owner's name: R. Robinson.

Address: Mooiplaats, Que Que.

Name of cow: Daisy.

Breed: Shorthorn.

Date of birth: 8/6/17.

Commenced record: 22/9/21.

Date.	Hours of milking.	Lbs. of milk.	Per cent. butter fat.	Lbs. butter fat.	Average per cent. butter fat.	Remarks.
9/10/21 ...	7 a.m.	10.5	3.4	.3570		Wet and cold
	5 p.m.	11.0	3.8	.4180		
	Totals ...	21.5		.7750	3.74	

I certify that I personally carried out the weighing and tests, and that they are correct.

Owner's signature: R. Robinson.

Tester's signature: N. Smith.

Date: 20/10/21.

Such a return is simple and representative, and should be adopted in this test. The pounds of butter fat are obtained by multiplying the pounds of milk by the percentage butter fat and dividing the result by 100, *e.g.*:—

$$10.5 \times 3.4 \div 100 = .3570$$

$$11.0 \times 3.8 \div 100 = .4180.$$

The average percentage butter fat is found by dividing the total amount of butter fat by the total amount of milk and multiplying by 100, *e.g.*:—

$$.7750 \div 21.5 \times 100 = 3.74.$$

This average percentage butter fat (in this case 3.74) is the figure taken to estimate the total production of butter fat for the period of 28 days under review.

A further return should be made as follows:—

Weekly Weighings and Butter Fat Return.

Owner's name: R. Robinson.

Address: Mooiplaats, Que Que.

Name of cow: Daisy.

Breed: Shorthorn.

Date of birth: 8/6/17.

Commenced record: 22/9/21.

Date.	Lbs. milk.	Lbs. milk : 7	Average per cent. butter fat.	Total butter fat in lbs.
2 10 21 ...	24.0	168		
4 10 21 ...	21.5	150.5		
16 10 21 ...	22.0	154.0		
23 10 21 ...	20.5	143.5		
		616.0	3.74	23.04

This return will be carefully filed at the Department of Agriculture, Salisbury, and a certificate issued showing the total amount of milk and butter fat produced in a lactation.

The certificate will take the form of a summary showing the production of milk and butter fat every 28 days of the particular cow under test.

ADVANTAGES TO BE DERIVED FROM MILK RECORDING.

1. By keeping milk records we can find out the poorest cows and those who do not pay for their feed.

2. By keeping milk records we find that those cows considered the highest producers are often the lowest.

3. By keeping milk records we prevent our best cows from being sold or slaughtered.

4. Milk records help us to discover great differences in cows as regards their persistency in milk flow.

5. Milk records help us to notice variations in yield and urge us to seek for the cause of these variations.

6. Milk records help us to bring in larger returns from fewer cows.

7. Milk records help to build up a profitable herd quickly, because heifers from the best cows only are kept as the basis of a dairy herd.

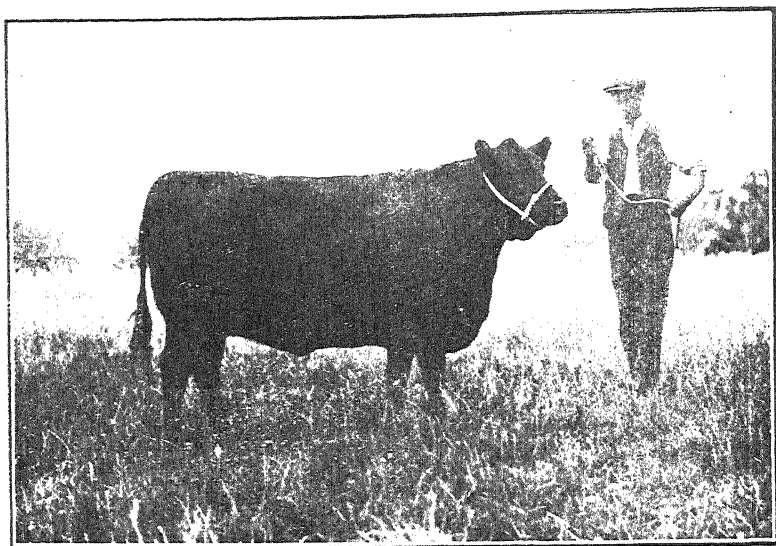
8. Milk records allow us to exercise more discrimination in apportioning feed according to yield.

9. Milk records emphasise the benefit of liberality in the feeding of succulent and digestible foodstuffs.

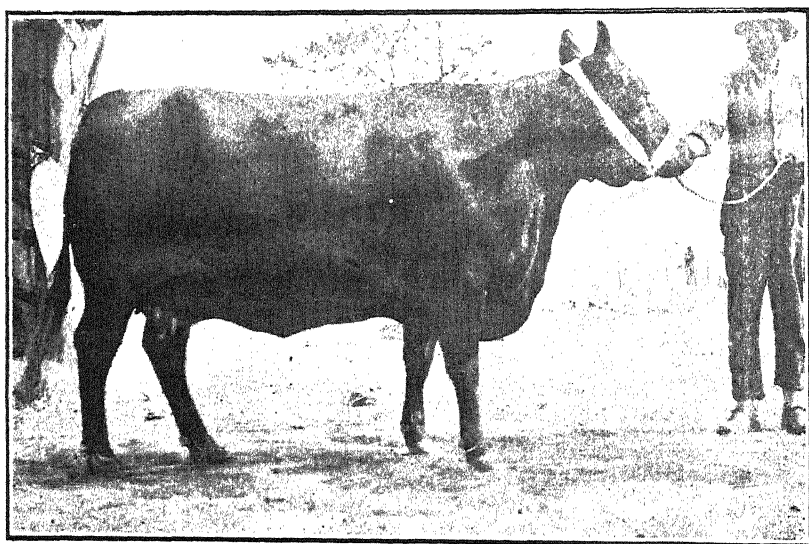
10. Milk records prove that it pays handsomely to give dairy cows the best care and kind treatment. This includes regularity in milking, protection from rain and cold, the advantage of stabling, and particularly the necessity for good and efficient milking.

11. Keeping records makes the farmer more observant of all the details which are essential to success.

12. Milk records develop the faculty of observation and induce reading and study.



"Simple of Maisemore" at 3 years.



"Simple of Maisemore" at Salisbury, 1921.

13. A great stimulus to excel is received, when records are compared with those of other farmers.

14. Native servants take a great interest in records. Consequently the cows under their charge get better attention.

15. Milk records increase the pleasure and interest in farming.

16. Financially the keeping of milk records is of great benefit. Young bulls are frequently sold at much higher prices if milk records of their dams are available than they otherwise would have been.

“Simple of Maisemore.”

A WONDERFUL RECORD.

“Simple of Maisemore,” bred by Mr. J. J. Cridlan, of Maisemore Park, Gloucestershire, has now finished her show career, and it is interesting to read what this grand Aberdeen Angus animal has done in the show ring. As a yearling she was placed third at the R.A.S.E., a position which many people thought was too low for her. Mr. Leo Robinsen bought her in 1917, and she was first shown at Bulawayo in 1918, when she was first in her class, champion female of her breed, champion animal of the breed, and champion female on the show. In 1919 she repeated the performance at Bulawayo, with the addition of beating the thousand guinea trophy winner, and thus entitling her to the championship of the whole show. In the same year at Salisbury show she won three championships and one first ticket. In Bulawayo in 1920 she was awarded three championships and one first prize, and at Salisbury in the same year she won three championships and a first ticket. She repeated this latter performance this year. The prize money she has won amounts to £473 in cash, and she captured the fifty guinea cup presented by Messrs. Stewarts and Lloyds on three occasions, thus winning it outright. She also won the fifty pound cup presented by the Mazoe Farmers' Association three times in succession, thus retaining it for good. In 1919 she won the Aberdeen Angus challenge cup, and also three major silver medals for 1918, 1919 and 1920. She has had four calves—two heifers and two bulls. The former died, but the latter are with their mother, one of which promises to turn out something better than a “kaffir-beast.”

Ticks Infesting Domestic Animals in Southern Rhodesia.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

(Concluded.)

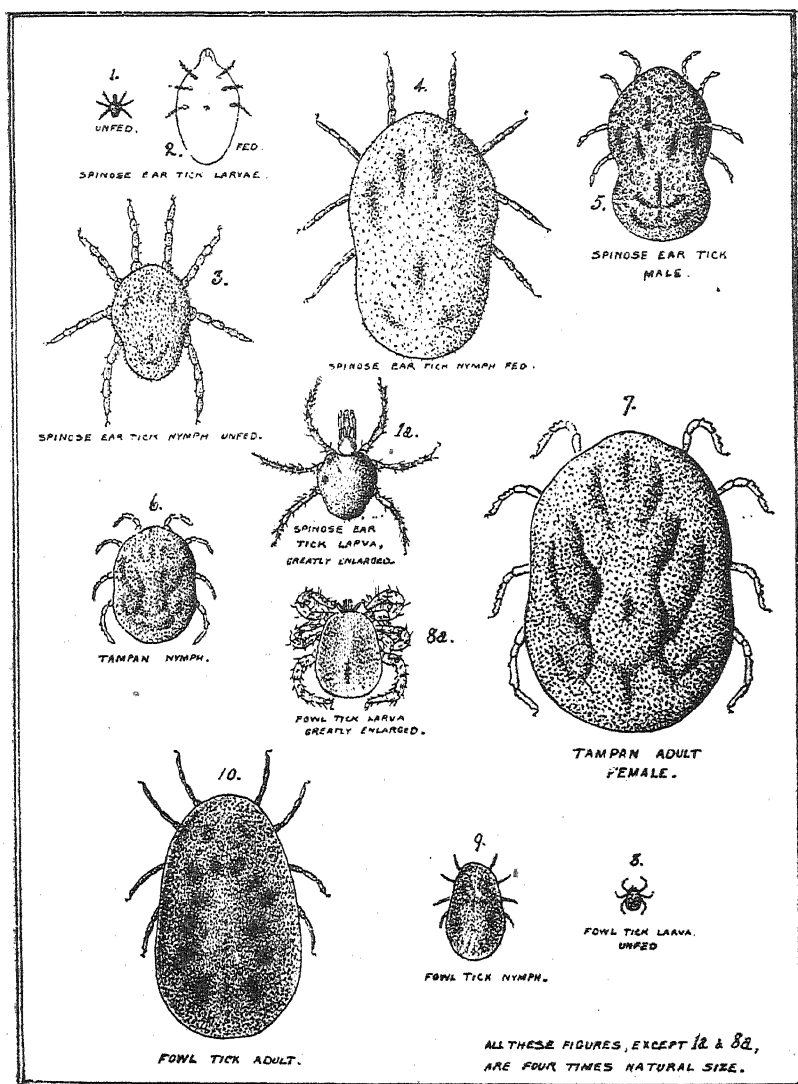
Besides the ticks we have dealt with, a number of other species of the family *Ixodidae* have been found in the Territory, but as they are not known to feed upon domestic animals they do not interest the stock owner and are therefore omitted.

We have now to deal with the second family of ticks (*Argasidae*), of which three species claim our attention. Before proceeding, however, it is necessary to point out that the ticks of this family show a more varied life cycle than those of the preceding family, and their feeding habits are in many respects different. These peculiarities will be dealt with under the heading of each species. As already indicated, these ticks are distinguishable from the common cattle ticks and the other members of the *Ixodidae* by the absence of a horny shield and the fact that the mouth parts (except in the larvæ) are hidden under the body when the tick is viewed from above.

The Spinose Ear Tick (*Ornithodoros megnini*, Duges).—This tick was originally described and studied in America and is no doubt an introduction to South Africa. It occurs in parts of the South African Union, but no specimens taken in Southern Rhodesia have as yet reached the writer. It is likely to come to light in the Territory at any time, however, and many specimens suspected of belonging to this species have been forwarded, only to prove to be examples of ear-infesting ticks belonging to the other family.

The name "Spinose Ear Tick" refers to the favourite feeding site of the early stages of the tick, and the short spines that cover the body of the nymph (see Plate II., Figs. 3 and 4). These spines are lost in the adult stage.

The larvæ (see Plate II., Figs. 1 and 1a) as they hatch from the eggs are six-legged, as is the case with all ticks. They attach themselves to their hosts after the manner of the common ticks and feed to repletion in about five days, swelling greatly in the process (see Plate II., Fig. 2). Remaining attached, they moult their skins after an interval and the nymphs appear (see Plate II., Fig. 3). These attach themselves again and also feed to repletion, taking from 35 to 98 days,



and swelling very greatly (see Plate II., Fig. 3). It has been stated that the nymphs do not moult during the feeding process, but in a recent publication* this is apparently called into question, the idea being that the nymphs moult without leaving the host. The full-fed nymphs leave the host and "crawl up several feet on posts, trees or the like, and hide in chinks and crevices." The nymphs shed their skins after some seven days in summer, and the adults appear (see Plate II., Fig. 5). The adults do not feed, and remain smaller in size than the full-fed nymphs. The eggs are laid in the crevices where the adults live, and the larvæ which hatch out seek a host and recommence the life cycle.

Some recent observations in South Africa indicate that fed nymphs do not necessarily climb to find a crevice in which to moult, but that they, and the adults and larvæ, may be found in any convenient shelter in a stable or kraal, even if it be on the ground. This species of tick is a denizen of places where animals congregate regularly and may attain great numbers in such localities, but does not infest the open veld to any serious extent. Moreover, it does not appear to thrive much in localities favoured with an abundant rainfall, and would appear more likely to establish itself in the western and southern parts of this Territory than in Mashonaland.

As methods of controlling ticks are to be dealt with later, nothing need be said on this subject here. The Spinose Ear Tick is not known to transmit any specific disease, but its presence in the ear causes great irritation and loss of condition in stock; young animals have been known to succumb to very heavy infestation.

This species has been found infesting the following hosts: Cattle, sheep, goats, horses, donkeys, dogs, cats, ostriches and man, but it is chiefly a pest of cattle and small stock.

The Tampan (*Ornithodoros moubata*, Murray).—This is the largest of the three species belonging to this family with which we have to deal. It resembles the Spinose Ear Tick more closely than it does the following species, but may be distinguished in the nymphal stages by the absence of spines on the body, and the fact that it does not normally infest the ear, nor remain attached to its host for any length of time. The adults are readily distinguished by the shape, the Spinose Ear Tick adult being "fiddle-shaped," with a strong constriction in the body, whilst the Tampan adult shows no trace of such a constriction.

The life cycle and habits of the Tampan differ considerably from the preceding species. The larva does not hatch out from the egg, but moults within, and the young nymph which emerges is the first active stage of the tick. The nymphs feed intermittently, remaining hidden in crevices during the day and sallying forth after the manner of a bed-bug to suck the blood of their victims at night. They moult several times in the course of their development, gaining in size, and finally reaching the adult stage. The adults, unlike the preceding species, also

* "Ticks," by Nuttall, Warburton, Cooper & Robinson. Part II., p. 330.

1



Dog Tick Larva.

2.



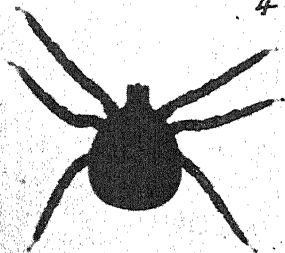
Dog Tick Nymph.

3.



Bont-leg Larva.

4



Fowl Tick Larva.

5.



Brown Tick Larva.

suck blood freely, and the female is stated to moult her skin repeatedly. The eggs are laid in the chinks and cracks where the ticks congregate, the female laying a small batch after each feed.

The Tampan is best known as a pest of man, transmitting the disease known as African relapsing fever (*Spirochaetosis*). It will, however, attack animals when opportunity occurs, and the writer found it in 1912 swarming in some extensive pig-styes in Matabeleland. It seems to be common in all parts of the Territory as a pest in native huts, especially perhaps those habitually used by travelling natives. The hosts need not be specified, as the tick will, when hungry, certainly feed on almost any warm-blooded animal, or even bird, that affords it an opportunity.

The transmission of African relapsing fever by the tick has been successfully studied. The female sucks blood containing the organisms, and "the latter pass into the ovaries of the tick and penetrate the undeveloped eggs where they multiply. They persist in the tick which develops from the egg and pass out of its mouth parts when it feeds in the first nymphal stage on a fresh host." The infected tick may harbour the organism and transmit the disease for months, and the organism is stated to be transmitted to the third generation of ticks, even though the second generation feeds on blood free from the organism.

The Fowl Tick (*Argas persicus*, Oken.).—This well known pest of fowl houses in the Territory may be distinguished in the nymphal and adult stages from both the preceding species by the flat back which meets the under surface of the body at a sharp angle, forming a definite edge all round the body. The name "Tampan" is frequently applied to the Fowl Tick, but should be reserved for the preceding species to avoid confusion.

The habits and life cycle are similar to those of the Tampan, with the important exception that the Fowl Tick larva hatches as such from the egg and is an active parasite. It attaches itself to its host and remains for some five to ten days, being commonly found under the wing. When fully engorged this larva is about one-twelfth of an inch in length. It now drops off its host and in about eight days in summer moults its skin and the nymph appears. The habits of the tick are now similar to those of the Tampan, already described. Mr. C. P. Lounsbury, who worked out the life history of this tick at the Cape, reared it from egg stage to the following egg stage in ten months.

The Fowl Tick transmits the fowl disease (*Spirochaetosis*), which is very prevalent in this Territory. It appears that after a tick has fed on infected blood, the organisms multiply in its body and it is able to infect any susceptible bird it feeds on for six months or more afterwards. Apart from its power to transmit disease, the tick is a very serious pest on account of direct injury inflicted, and the writer has seen cases in which fowls, introduced to badly infested premises, died of exhaustion within two days.

The tick is stated to be a pest of man in Persia, but in African experience it is pre-eminently a poultry pest, attacking fowls, geese, turkeys, ducks, pigeons and even canary birds.

THE MOUTH PARTS OF TICKS.

It may interest our readers to know something of the structure of the mouth parts of ticks. As is well known, a tick when pulled off an animal or human being frequently either leaves its "head" behind or brings away a small piece of skin and flesh with it. A study of Fig. 16 in Plate I. will indicate why this occurs. The "beak" of the tick which enters the skin (marked "hypostome" in the figure) is armed with a series of backward projecting processes, each one like the barb on a fish hook. It is evident that although this may be pushed comparatively smoothly into the skin, it cannot be pulled out forcibly without something giving way. It is by means of this beak or hypostome that the tick is anchored to its host during the process of blood-sucking. It could not possibly maintain its position during the process of engorgement by the power of its legs alone, as these are, as a matter of fact, comparatively useless to a swollen tick whilst on its host.

The mode of insertion of the barbed beak is also a matter of interest. It is conceivable that a tick might simply push it in whilst maintaining a grip with its highly prehensile feet, but none the less this is probably a mechanical impossibility, because there is an elaborate and rather beautiful contrivance for assisting the passage of the beak into the skin. This contrivance is shown at Fig. 15 on Plate I. The under side of the beak alone carries the backward-pointing barbs. On its upper surface lie the modified mandibles, bearing a few outward directed recurved lancets at their extremities. These mandibles are capable of being thrust out beyond the beak and are attached to muscles which admit of their being drawn back strongly until the beak projects well beyond them. The tick, seeking to attach itself to its hosts, thrusts out the hooked mandibles, and, the portion bearing the hooks at the extremity being movable, commences to cut a hole in the skin, into which the beak is worked. The mandibles continue to cut a way for the beak until the latter is buried up to its base. The palps or feelers do not enter the skin, but are spread apart on the surface as the beak enters.

The fundamental characteristics of the mouth parts are common to all ticks, whichever family they belong to, but there are considerable minor modifications in respect to the length and shape of the hypostome, and the completeness or otherwise of its armament of barbs. Ticks like the nymphal and adult stages of the Fowl Tick, which feed quickly, have few barbs on their beaks, as they do not require to anchor themselves so firmly as the Ixodid ticks, which feed over a considerable length of time. The adults of the Spinose Ear Tick, which do not feed at all, have reduced mouth parts with an unarmed beak.

METHODS EMPLOYED IN CONTROLLING TICKS.

Cattle Ticks (*Ixodidae*).—A number of methods have been recommended from time to time in respect to the destruction of the common cattle ticks (family *Ixodidae*), and probably several of these are still employed in other countries, but as far as South Africa is concerned, dipping in an arsenical solution is almost universally adopted when

any considerable number of cattle have to be treated. Spraying is sometimes resorted to in the case of small herds. Before dealing with the subject of dipping, it may be as well, however, to touch briefly on one or two other methods.

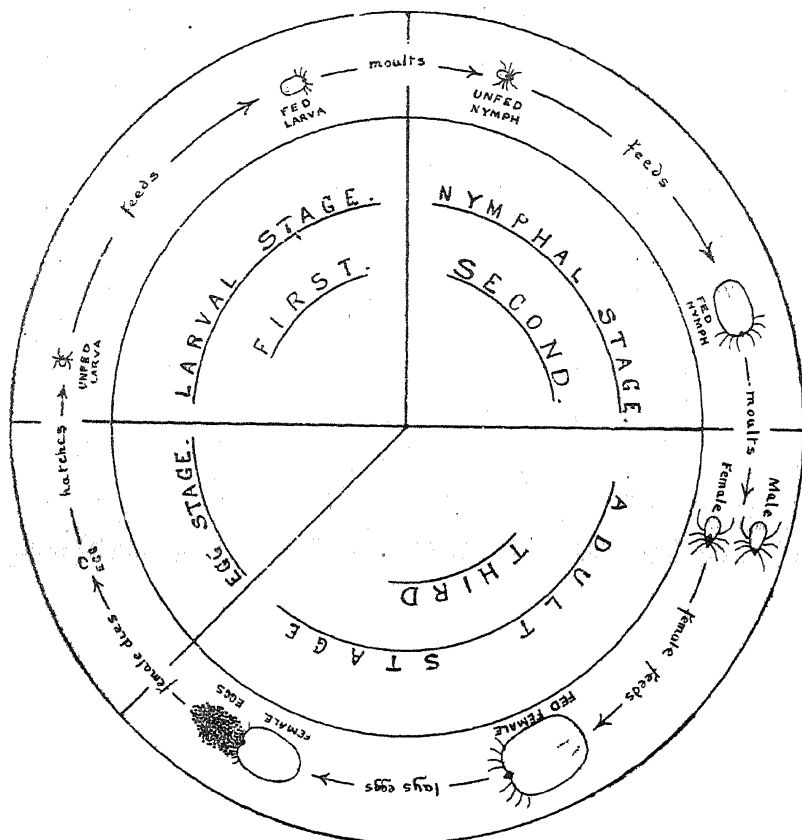


DIAGRAM ILLUSTRATING THE LIFE CYCLE
OF A CATTLE TICK.

PLATE IV

(1) *Spraying with Paraffin and Water*—Paraffin is one of the most potent insecticides known and kills ticks very rapidly by contact. It does not do a great deal of harm to animals even if sprayed in the pure state on to their hides, but is, of course, very expensive. It has the disadvantage of not mixing readily with water, and so can only be diluted in a specially constructed pump which mixes the paraffin and water mechanically in the delivery hose pipe. Experiments have shown that the minimum effective strength against ticks is 15 per cent.

paraffin in water, and for reliable effect the pump is usually adjusted to 25 per cent., as even the best pumps of this design are uncertain in their delivery. This form of spraying is effective, but troublesome, laborious and very expensive compared with the use of arsenical dips.

(2) *Hand Dressing*.—Smearing the udders of cows and the inside of ears of stock with greasy preparations to destroy ticks which attack these parts and are not readily killed by dipping is of considerable value. Tick greases of this nature are on the market. Crude petroleum is stated to be of value in this connection, as also is a mixture of paraffin oil and paraffin wax, according to a formula designed by Lieut.-Col. Watkins-Pitchford in Natal, viz.: paraffin oil, one quart; paraffin wax candles, No. 6, 6 to 8. One quart of paraffin should be *cautiously* warmed in an open vessel and the candles broken in small pieces, dropped into the oil, when they will rapidly dissolve. In hot weather it will be found that eight candles to the quart are necessary to produce a mixture of the required consistency, while during cold weather five or six candles will be found sufficient.

(3) *Burning the Grass*.—This operation is of some value in reducing the number of ticks where it can be carried out and if it be done intelligently. Ordinary winter burning effects little, as the ticks are more or less dormant during the cold weather. For the purposes of tick destruction it should be carried out after tick life has revived, that is *as late in the season as possible*. October, or even November, if the weather permits, are probably the best months from the tick killing point of view.

(4) *Starvation*.—Ticks will live for a number of months without feeding, but they are not immortal, and if all animals can be kept away from pastures for a sufficient length of time the ticks present must die out. Conditions in Southern Rhodesia are, however, probably less favourable to the adoption of starvation measures than to many other parts of the world owing to the abundance of animal life, such as small buck, hares, and jackals, ground vermin, etc., that occur on most farms and cannot be kept out of an ordinary fenced paddock. Elaborate methods based on the life history and known duration of the different feeding stages of ticks have been evolved and applied in the United States of America, but, although the writer has details of these methods before him, it appears unnecessary to deal with them in the present article, as they are quite unlikely to be adopted in this Territory. As a general statement, it has been affirmed that if a piece of land can be kept absolutely free from tick hosts for a period of fifteen months the ticks must be eradicated (Theiler). Ticks will, however, live longer than this in confinement, as the writer clearly recalls a few Brown Tick nymphs surviving for eighteen months in a glass bottle at Capetown during the time he was assisting Mr. C. P. Lounsbury in disease transmission experiments.

(5) *Dipping*.—There is no intention of dealing exhaustively with the subject of dipping in this article, but it is desirable to mention the fundamental principles underlying the practice as at present applied in this Territory.

The active agent of an effective dip against ticks is arsenic in a soluble form. As a matter of fact, arsenite of soda is the chemical

almost universally employed in both home-made and proprietary dips. Good results were obtained in the initial experiments in the Cape Colony with a plain solution of this chemical in water, generally employed at that time as a 14-day dip at a strength of 1 lb. of 60 per cent. arsenite to 25—30 gallons of water. There are, however, two alleged drawbacks to the use of the plain solution, namely, that it is slightly inclined to injure the skin of the animal, especially with repeated applications, and that, owing to the high "surface tension" of water, it does not "run" over-well, and is therefore slightly deficient in wetting power. It may sound somewhat curious to state that water is deficient in wetting power, but none the less the addition of certain agents diminishes the surface tension of the liquid and presumably causes it to penetrate more thoroughly to the hide of the dipped animal through the hair. The addition of soap, for instance, has a marked effect in this direction. It is obvious, therefore, that the addition of substances to the arsenite of soda solution which will check the caustic action on the hides of the animals and cause the liquid to wet the animals more thoroughly is an advantage. There is no great difficulty about this, and most proprietary dips have a special formula of their own. The following formulæ are, however, the ones devised by Watkins-Pitchford in Natal for different intervals between the dips, and are generally referred to as the

LABORATORY DIPS.

	3-day.	7-day.	14-day
Arsenite of soda 80 per cent. ...	4 lb.	8 lb.	12 lb.
Soft soap	3 lb.	6 lb.	6 lb.
Paraffin	1 gall.	2 galls.	2 galls.
Water	400 galls.	400 galls.	400 galls.

The soap and arsenite should be dissolved separately in a sufficient quantity of hot water; the soap solution should then be added to the paraffin and beaten up into an emulsion; mix both solutions together and add water to make up 400 gallons, stirring vigorously in the meantime.

Sir Arnold Theiler, in a recent publication,* states that "most farmers now omit the soft soap and paraffin and use a plain aqueous solution of arsenite of soda, adhering to the strength laid down in the Pitchford formula and using 1 lb., 2 lb. or 3 lb. per 100 gallons of water, according to whether three-day, five- to seven-day, or fourteen-day dipping is contemplated." It would appear, therefore, that the advantages of the emollients in the dip are not universally considered sufficient to justify the extra expense involved in their use.

In parts of the Territory where the Cattle Cleansing Ordinance is in force seven-day dipping is obligatory. Fourteen-day dipping, although a greater strength of dip is used, is not so effective in eradicating certain ticks as the weaker solution used more frequently. Three-day dipping is employed in dealing with outbreaks of East Coast Fever. In the South African Union, however, seven-day dip strength used at five days' interval is stated by Theiler to be coming into favour in dealing with East Coast Fever outbreaks, three-day dipping having

*"Diseases, Ticks and their Eradication." Journ. Dept. Agric., S.A. Union, II., No. 2.

not always proved effective. The dipping is supplemented by hand-dressing of the depths of the ear, the sheath, anus and brush of the tail.

The reason for the increased effectiveness of the shorter interval dipping against certain ticks lies in the length of time occupied by the various stages in feeding. Ticks with a life cycle of the three host type are less easily eradicated by fourteen-day dipping than those which feed only on one host, for the reason that the immature stages may attach, feed up and fall off again between the dips, whereas the Blue Tick, for instance, which passes through all its stages on the one host and occupies some three weeks or more in the process, must undergo immersion at least once, even at a fourteen-day interval, and would frequently undergo two. With ticks feeding on three hosts in the course of their development, of which the Brown Tick may be taken as an example, the larval feeding period is the shortest, then the nymphal, and then the adult. The idea of the three-day dip is to ensure that all the larvæ undergo at least one immersion, and of course the nymphs and adults as well. Cattle will not, however, endure too frequent dipping at the greater strengths without injury, and the dip needs to be weakened in proportion as the interval is decreased, and owing to the greater susceptibility of the larval and nymphal stages, they can be destroyed by the weaker dips, although at some sacrifice of killing power as regards the adults. As the infection of East Coast Fever is taken up by the larvæ or nymphs, and is not transmitted through the eggs, it is the two early stages of the tick that it is most important should be quickly destroyed in checking an outbreak. Regular dipping at the seven-day interval will eventually eradicate the Brown Tick, but it would take considerably longer to check an outbreak of the disease than the three-day dip.

Ticks which feed well inside the ears, like the Red Tick larvæ and nymphs (and this species is also an agent in transmitting East Coast Fever), are not effectively killed by dips. The same remark applies to ticks which attach to bare parts of the body, as the Red Tick adults do under the tail, or in the brush of the tail, and these must be treated by hand-dressing in fighting an outbreak.

HOW DO ARSENICAL DIPS KILL TICKS?

Compounds of arsenic, as is well known, are largely used as stomach poisons in insecticidal practice, having been found effective against leaf-eating insects, apple codling, and, in fact, any insects whose feeding habits render it possible to place the arsenic in such a position that it is eaten with the natural food or with some artificial food attractive to the insects concerned. As a contact insecticide arsenic has been found in agricultural and horticultural practice to have little value. Compounds of arsenic used for application to plants are, however, practically insoluble in water, because the soluble compounds are deadly to plant life. Arsenite of soda, which forms the basis of arsenical cattle dips, is completely soluble in water, and it is highly probable that it has considerable action as a contact insecticide, being absorbed by the ticks, at least in certain stages of their development. The writer recalls some experiments carried out in Cape Town under the direction of Mr. C. P. Lounsbury, in which engorged female blue

ticks were taken from an unsprayed animal and placed in contact in the dishes, used for rearing ticks at the time, with hair cut from an animal recently sprayed with arsenite of soda solution, the hair being cut after drying. These ticks behaved very much as ticks taken from a sprayed animal, either dying without laying eggs, or, if a few eggs were laid, these usually failed to hatch. A very few larvæ occasionally hatched. In this case it was obvious that the poison was absorbed through the skin of the tick. The reduced effect of arsenical dips on ticks which attach to bare places on the host also indicates that contact with hair coated with arsenic is a factor in bringing about the destruction of these parasites.

It has, however, been shown that regular dipping results in the tissues immediately underlying the skin of animals becoming stored with arsenic. This is stated to be a condition which is gradually acquired, the system becoming accustomed, with the continuance of dipping, to holding the arsenic without detriment to the animal. The storage of arsenic in these tissues does not go beyond a certain point, and the poison is rapidly eliminated if dipping is discontinued. The arsenic in these tissues is sufficient under conditions of regular and short interval dipping, as was first shown by Lounsbury at the Cape in 1904, to kill a certain percentage of the ticks, especially larval ticks, which attach, even if they have not been through the dip, and also apparently to prevent some proportion of ticks from attaching at all. It appears, therefore, that arsenical dips act also as a stomach poison on ticks, and that enough may be taken in through the mouth parts from a regularly dipped animal to cause death.

One point which, as far as the writer is aware, has not been elucidated is the exact cause of the reduced efficacy of dipping against such ticks as the Bont-leg and the Bont. These ticks possess much longer beaks than the Blue and Brown ticks and their allies, and it may be that these penetrate too far through the skin to take up the arsenic. On the other hand, they have a much tougher skin than the smaller species of ticks, and may on this account absorb less arsenic from the hair. Also, the females being larger are less well covered by the hair of the host. Whatever the reason may be, these large ticks, particularly the Bont-leg Tick, persist in regularly dipped herds long after the Blue and Brown Ticks have been practically eliminated. The fact that the early stages of the Bont-leg are passed on wild, or at any rate undipped hosts, of course gives this tick a great advantage.

CONTROL OF TICKS OF THE FAMILY ARCASIDAE.

Spinose Ear Tick.—This tick, owing to its retreat far inside the ear, does not yield to ordinary arsenical dipping. The ears of the infested animals need to be dressed by hand. There are proprietary dressings for this purpose on the market. Mr. G. A. H. Bedford, Entomologist, Division of Veterinary Research, South African Union, recommends the following:—"Two parts each Stockholm tar and oil to one part turpentine. Sweet oil was always recommended formerly, but cheaper oils have been found to be equally effective." From a teaspoonful to a tablespoonful should be poured into each ear according to the size of the animal. On badly infested farms it may be necessary

to treat the animals every two or three weeks, in exceptional cases once a week, otherwise treatment at monthly intervals is sufficient.

Permanent kraals, especially those built of loose stones or bricks, should be avoided. Wire kraals are best, and the position should be shifted as soon as the ticks show a sign of increase. Brushwood packed along the fence will afford shelter to the animals, and should be fired after the wire has been removed. For permanent kraals and cattle sheds good brick work plastered over so as to afford no lurking place for the ticks is desirable.

It need hardly be said that cattle introduced from the South African Union, especially from a known Spinose Ear Tick area, should be hand-dressed carefully to avoid the risk of introducing the tick to Rhodesian farms.

Tampan.—As this tick leads an independent life from first to last, taking only a space of time measured by minutes over its feeding operations, it is not possible to control it by any treatment of its hosts. The seclusion of its diurnal retreats further renders its destruction a very difficult matter indeed. As a human pest in native huts of an ephemeral form of construction the situation is best met by burning the whole structure down and building anew elsewhere. To avoid being bitten by this pest and so running the risk of contracting relapsing fever, any spots regularly frequented by natives should be avoided, particularly native huts and sandy spots where travelling natives regularly camp. The instance of the infested pig-sties already mentioned constituted a practically hopeless case. The tick can, of course, be destroyed by heat, but large numbers invariably escape the most thorough firing if the stone or brick walls afford sufficiently deep hiding places, as such walls almost invariably do. Plastering or tarring over the surfaces of the walls and so imprisoning the ticks is practicable in certain cases. In building permanent pig-sties the walls should certainly be constructed so as to afford as little shelter for the ticks as possible. Brick walls covered with cement and cement floors are almost ideal as far as cleanliness and parasite control are concerned. These ticks are probably largely spread in the bedding and clothing of natives, and a single fed female, dropped in favourable surroundings, may be the means of gradually infesting an extensive building in a gross degree.

The Fowl Tick.—Consistent care when introducing new birds to one's houses or runs, provided there are no very close neighbours, should keep away infestation with this tick indefinitely. The pest is, however, extremely prevalent in the Territory, and, as is constantly emphasised by the Poultry Expert of the Department of Agriculture, its presence is not only an adverse factor in regard to the yield of eggs, but is the cause of death of a large number of birds. Fowls certainly become more or less immune to the disease conveyed by the ticks, and chickens reared on the premises may not show a high mortality. New birds from uninfested premises, however, commonly succumb very quickly when exposed to infection, and this is particularly disappointing if a high price has been paid for them. When commencing poultry keeping on clean premises, therefore, no birds should be introduced without the most careful precautions. As already stated, the larval stage of this

tick remains attached to its host for an average of about five days, and it is in this stage that the tick is frequently introduced. Birds from elsewhere are, therefore, best kept in separate crates for ten days or more to allow of any larvæ dropping off, and then the crates should be burnt. Needless to say these crates, with the contained birds, should be kept away from the fowl runs, and precaution should be taken against the escape of any ticks which may drop off. This is the most difficult point. Probably the easiest method is to place the crates in the middle of a quantity of dry grass, into which the engorged larval ticks, after leaving the birds, will penetrate. This grass should be in such a position that it can be burnt without moving it. Coops, crates and other poultry accessories may, of course, harbour the ticks in any stage, and, if too valuable to be destroyed, can be soaked with paraffin. It is best to take them to pieces for a thorough cleaning, over a sheet of iron, or something similar, to prevent any ticks being dropped about where they cannot be seen, and to reconstruct them again. As an alternative they can be soaked for several days in a solution that will kill the ticks.

The most comprehensive report of tests of substances against the Fowl Tick in the writer's hands is contained in a bulletin published by Mr. D. F. Laurie, Poultry Expert of the Department of Agriculture in South Australia, in 1912, under the title of "The Poultry Tick." From these tests the fact emerges, as emphasised by the author, that paraffin emulsion "stands out as the most effective and cheapest in use." Other substances which killed the ticks, but only at strengths that rendered their use either expensive or quite impracticable, included:—Carbolic acid, 5 per cent.; phenytas, 5 per cent.; Jeyes' fluid, 10 per cent.; lysol, 10 per cent.; Cyllin, 5 per cent.; cresol soap, 5 per cent.; formalin, 2½ per cent.; caustic soda and caustic potash, 10 per cent. Paraffin emulsion has long been recommended as a means of destroying these ticks, but the formula given by Mr. Laurie (*i.e.*; paraffin, one part; boiling soapsuds, nine parts) differs somewhat from the emulsion as usually prepared in this Territory and appears to provide for a very variable quantity of soap. The following is a more exact formula:—

Soap	1 lb.
Paraffin oil	4 gallons.

Cut up soap and boil until dissolved in 2 gallons of water. Remove from fire and immediately add to the oil. Churn up violently for fully five minutes by pumping through spray-pump, or fully ten minutes with a paddle, until a creamy uniform liquid is formed. This constitutes the stock solution which will keep indefinitely. To make a solution containing 10 per cent. of paraffin add 6½ gallons of water to each gallon of the stock solution.

The treatment of infested premises calls for great thoroughness. Houses constructed entirely of iron, as many fowl houses are, can be roasted by burning a quantity of dry grass within and the ticks exterminated in this way. The writer has used a plumber's blow-lamp with good effect in brick buildings, but even so it is remarkable how the heat fails to penetrate deep cracks between the bricks, and many ticks escape a piecemeal treatment of this nature. Spraying the houses once a fortnight with a 10 per cent. solution of paraffin emulsion, applied as

hot as possible, is a good measure to keep down the pests. Pure paraffin is a good destroying agent to run into any cracks known to harbour the ticks. Brick walls should, if possible, be given a cement coating to do away with the natural hiding places of the ticks and imprison such as may be present. Wood work can be covered with hot coal tar to seal up the crevices. The smooth walls of *pisé* work afford practically no foot-hold for the ticks, provided they are free from cracks; in fact, the golden motto is to avoid cracks in the walls of the houses as much as possible. The perches should be removable, and be taken down regularly for cleansing purposes. Infested houses of rough wood and grass, which can easily be replaced, are best destroyed by fire. Wood and iron buildings can be taken down, thoroughly cleansed and re-erected, preferably on a new site. The ground where the old house stood can be saturated with paraffin or heavily fired by burning grass and brushwood on the surface.

TABLE OF DISEASES KNOWN TO BE TRANSMITTED BY
SOUTH AFRICAN TICKS.

Disease.	Host.	Ticks conveying.
East Coast Fever ...	Cattle	Brown Tick Red-legged Tick Black-pitted Tick Cape Brown Tick Probably others of same genus (<i>Rhipicephalus</i>)
Redwater ...	Cattle	Blue Tick Brown Tick Red-legged Tick
Gallsickness ... (<i>Anaplasmosis</i>)	Cattle	Blue Tick Black-pitted Tick
Gallsickness ... (<i>Gonderia mutans</i>)	Cattle	Brown Tick Red-legged Tick
Biliary Fever of the Horse	Horse Mule Donkey	Red-legged Tick
Biliary Fever or Malignant Jaundice	Dog	Dog Tick European Brown Tick
Heartwater ...	Cattle Sheep Goats	Bont Tick Variegated Bont Tick
<i>Spirilliosis</i> ...	Horse Cattle Sheep	Blue Tick Red-legged Tick
African Relapsing Fever ...	Man	Tampan (<i>Ornithodoros moubata</i>)
<i>Spirorchetosis</i> ...	Fowls	Fowl Tick Tampan

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The illustrations in the Plates are original with the exception of Figs. 15 and 16 on Plate I., which were roughly copied at a reduced size from Messrs. Wm. Cooper & Nephews' pamphlet "Ticks in relation to Diseases of Stock," and the figures of the Spinose Ear Tick on Plate II. The latter were copied or compiled from figures appearing in Messrs. Nuttall & Warburton's "Ticks: a Monograph of the Ixodoidea."

Arsenic in the Stomach Contents of Cattle.

By A. W. FACER, B.A., A.I.C., Chemist.

In the course of the routine work of the Chemical Laboratory of the Department of Agriculture, it is frequently found that a sample submitted for toxicological examination contains an appreciable quantity of arsenic, but that the amount present is insufficient to warrant a definite deduction that death was due to arsenical poisoning. As arsenic is a purgative and therefore self-eliminating in its action, diagnosis in such cases is difficult, and the question arises whether the quantities found are due to residues of toxic doses, the greater part of which might have been eliminated by several days of violent purging. On the other hand, it has to be borne in mind that regularly dipped animals are constantly absorbing arsenic through their skins from the tank solutions, and that as the stomach is one of the organs in which arsenic is known to accumulate after absorption, the arsenic found in such cases may be a harmless normality in regularly dipped animals.

In order to obtain some information concerning this, an investigation has been carried out, the results of which are not only very interesting, but also of value in that they enable the analyst to deduce whether arsenical poisoning was the probable cause of death in suspected cases of poisoning.

Arrangements were made for samples to be taken from healthy animals which had been slaughtered at the local abattoirs. Samples, which consisted of portions of the walls and contents of the 1st and 4th stomachs (taken separately), were only drawn from animals which were known to have been regularly dipped for at least one year. It was hoped at first that it might be possible to obtain a series of samples taken from animals dipped 2, 3, 4, etc., days prior to slaughter, in order to see if there was any reduction in the quantity of arsenic present as the interval from the last dipping was increased; but it was found impracticable to do this, and the idea was reluctantly relinquished.

The standard method of analysis at this Laboratory in cases of suspected arsenical poisoning is as follows:—

TYPICAL POISON MIRROR.



1 MG. MIRROR.



MAXIMUM MIRROR OF SERIES.



AVERAGE MIRROR OF SERIES.



BLANK TUBE.



*60 gms., consisting of 30 gms. of contents and 30 gms. of the wall tissue of the stomach, are weighed out, treated with 30 cc. of a saturated solution of magnesia in nitric acid, taken to dryness, heated till pure white in the muffle, cooled, taken up with pure dilute sulphuric acid and the arsenic determined by the Marsh apparatus.

In order that the results of the investigation might be comparable with those of routine poison analyses, the samples were analysed exactly as described above.

The solutions and reagents employed were as follows:—

- (1) A saturated solution of magnesia in nitric acid.
- (2) Dilute sulphuric acid (1/4) for extraction of the residue after ignition.
- (3) Dilute sulphuric acid (1/4) containing sufficient copper sulphate solution for efficient generation of hydrogen in the Marsh apparatus.
- (4) Pure granulated zinc for the Marsh test.

The liquid reagents were made up in sufficient quantity for the same solutions to be employed in all the analyses included in this report, and their purity was tested by the following process:—

Four quantities, each of 30 cc., of the saturated solution of magnesia in nitric acid were evaporated to dryness, ignited, extracted with 60 cc. of the dilute sulphuric acid and then put through the Marsh test. In three of these tests no trace of arsenic was obtained: in one test a very faint trace (in the neighbourhood of .001 milligramme) was obtained.

It was thus proved that any arsenic (in excess of .001 mg.) found in analyses under this investigation is not due to reagents, and must therefore be present in the samples analysed. The amounts of arsenic in the samples examined were ascertained by comparing the "Marsh" mirrors obtained in the analyses with a series of standard mirrors, ranging from .1 mg. to .005 mg. of arsenious oxide. These were prepared (in duplicate) by "Marshing" the required quantities of a series of carefully standardised solutions of sodium arsenite. The mirrors corresponding to .005 mg. arsenious oxide were very faint, and it was found impossible to estimate quantities less than this with any degree of certainty. The amounts of arsenic (expressed in terms of milligrammes of arsenious oxide) found in 60 gramme quantities of the samples analysed are recorded in the following table:—

* *Vide* "Analyst," 1904, p. 336.

Animal No.	1st stomach. Arsenious oxide.	4th stomach. Arsenious oxide.
	mg.	mg.
1	.0025	.005
2	Nil (.001 ?)	.05
3	.05	.0075
4	.01	.035
5	.04	.01
6	.035	.005
7	.0075	.02
8	.035	.025
9	.025	.025
10	.025	.01
11	.005	Nil (.001 ?)
12	.005	.01
13	.005	.035
14	.01	.0075
15	.01	.0075
16	.01	.005
17	.025	.035
18	.04	.035
19	.035	.0075
20	.01	.01
21	.01	.015
22	.02	Nil (.001 ?)
23	.015	
24	.04	.01
Average	.0196	.0161

In this table samples on the horizontal lines are from the same animals.

The above results were obtained from samples taken from animals whose ages ranged from 2½ to 8 years, some of which had been regularly dipped since birth. The intervals between last dipping and slaughter varied between a minimum of 6 and a maximum of 12 days. The amounts of arsenic found do not appear to be influenced by the age of the animals, nor (within the limits above given) by the interval between last dipping and slaughter. The averages for the 1st and 4th stomachs do not differ by any appreciable quantity, and the maximum and minimum amounts in both series are the same, *i.e.*, .05 mg. and nil respectively. It is interesting to note that no arsenic was found in a routine sample of stomach contents which was submitted from a non-dipping area.

Conclusions.—(1) 60 gm. portions (containing 50 per cent. each of walls and contents) of the 1st and 4th stomachs of healthy animals which have been regularly dipped for one year have been shown to contain an average amount of arsenic corresponding to .0175 mg. of arsenious oxide, and maximum amounts corresponding to .05 mg. of arsenious oxide. These quantities are equivalent to an average of .0020 grain and a maximum of .005 grain per pound.

(2) These quantities, although showing up very definitely in Marsh tubes, are considerably less than those found in cases where death is ascribed to arsenical poisoning. In such cases a mirror corresponding to .5 mg. of arsenious oxide, and frequently much more, is usually obtained.

(3) Unless similar portions of stomach contents of regularly dipped animals are found to contain considerably more arsenic than is equivalent to .05 mg. of arsenious oxide, death cannot be ascribed to arsenical poisoning from the results of chemical analyses.

Acknowledgments are made to the Chief Veterinary Surgeon, Cattle Inspector Miller, Mr. Symmonds of the Premier Butchery and Messrs. Grieve & Gibbons of the Farmers' Co-operative Butchery, Salisbury, for their assistance in obtaining the samples required for this investigation.

Loading Bag Maize in Railway Trucks.

By C. P. ROBINSON, Assistant Irrigation Engineer.

Farmers and others often complain of the loss of maize bags from trucks while in transit, and this loss is usually attributed to rough shunting. It is not generally realised, however, that a very large proportion of this loss is due to faulty loading of the trucks in the first place. However carefully a train is handled there is always a certain amount of shaking and swaying, and unless the top bags in a truck are firmly packed some of them are almost certain to fall off. It is with the idea of illustrating how bags can be firmly packed so that they do not shake off that these notes are given.

The essential part of the loading is the same for all sizes of truck, there being only slight differences in detail in order to fit the bags into the different sizes. The principle of the loading is that the top bags are so wedged in that there is no possibility of their falling off the sides of the truck, and their tendency to slip off the ends is resisted by the manner in which they are wedged together. How this wedging is obtained will be best understood by an examination of the accompanying diagrams. These show the method of loading of the different types of truck commonly used on our railways. The numbers in the diagrams refer to the order in which the bags are to be loaded in the trucks, and should be carefully followed.

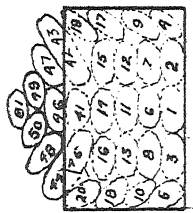
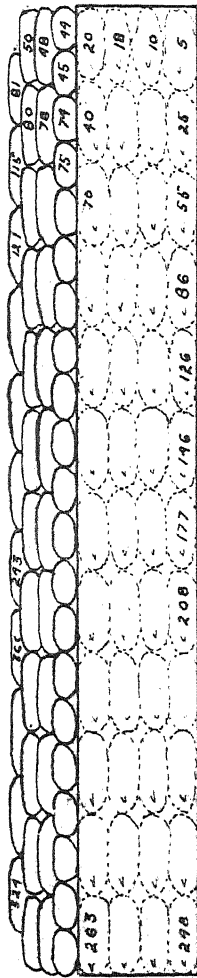
Let us consider the loading of the first truck. This is a steel bogie truck capable of carrying a load of 74,000 lbs. or about 365 bags of maize.

The bags are built up in vertical rows from the ends, not in layers, as is sometimes done, which necessitates the bags comprising the top layers being lifted straight from the ground to the top of the truck in one operation. The first bag is placed lengthwise in the centre of the truck with its one end against the end of the truck. The second and third bags are placed on either side of the first bag, and then the fourth and fifth bags are wedged between the sides of the truck and the bags already placed. The sixth bag is placed on top of the first bag and the operation is repeated until, in this case, 20 bags have been placed.

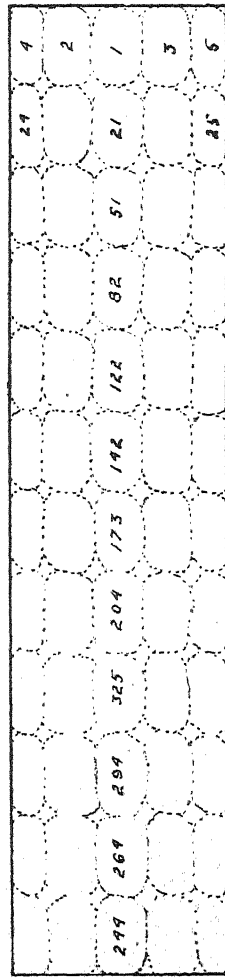
Now it will be observed that the bags that have been placed at the sides of the truck cannot lie flat like the centre bags, but are on their sides, and therefore the top of the top layer of side bags is higher than

Load 74000 lbs

Capacity 365 Bags

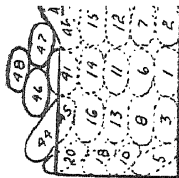
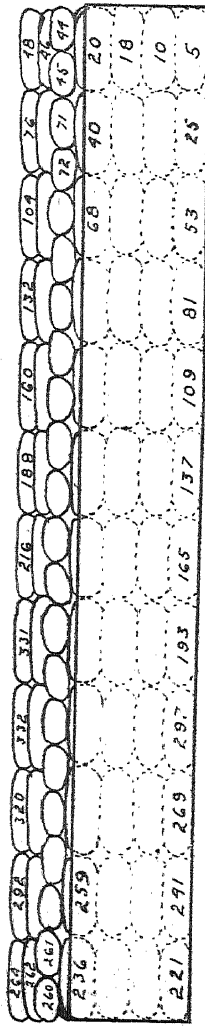


Start loading from one e
and load bags 1 to 24;
then load from the oth
end bags 244 to 365

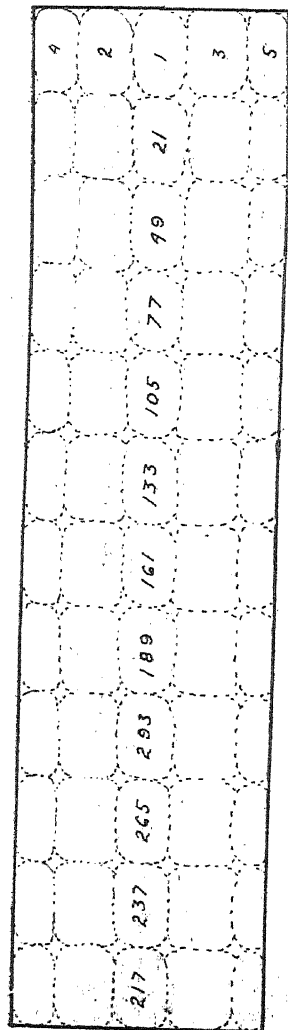


Load 67200 lbs

Capacity 332 Bags



*Start loading from one
and load bags 1 to 216 th
load from the other end
bags 217 to 332*



the top of the top layer of centre bags. We thus have the beginning of the wedge that we desire. The top of the bags is now level with the sides of the truck, and it is necessary to place a couple of bags crosswise at each side to complete the wedge. As, however, two bags placed crosswise are slightly larger than one bag lengthwise, it is first necessary to build up another row of bags like the first row. Bags 21 to 40 are thus placed in a similar manner to bags 1 to 20. Then place the forty-first bag on the top of the first row in the centre, and on either side of it place two bags crosswise, *e.g.*, bags 42 to 45; then place bags 46 to 50 as shown. The top row of all being stepped back half a bag, another row must be completed before it can be placed. Therefore start the third row placing bags 51 to 70, then on the top of the second row bags 71 to 80. Finally on the top of all, between the completed first and second rows, place the 81st bag.

The following rows are built up in an exactly similar manner until the 243rd bag has been placed. Now, in this class of truck there are two pairs of doors, and after placing the 243rd bag the foot of the bags will be opposite one pair of doors. It is now advisable to start loading from the other end of the truck, so that the closure will come opposite the doors. In this way only the last few bags have to be lifted the full height of the truck, the others being first lifted into the truck and then into their position.

It is found that 21 or 22 bags crosswise are equal to 12 bags lengthwise. These cross-bags, being 42, 44, are the key to the successful loading of the truck, as they wedge in the top bags, and prevent them moving.

The other sizes of trucks are loaded in much the same way, the slight differences in detail due to the different sizes being easily followed from the figures in the diagram.

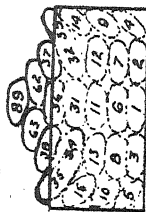
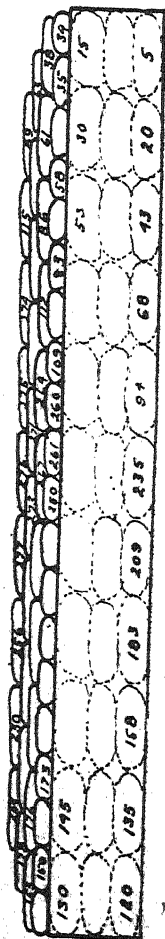
In the 56,000 lb. truck there is only one pair of doors, in the centre, and therefore the building up from the two ends is made to meet in the centre. In the 30,000 lb. truck the length is such that a complete number of bags will not lie lengthwise, and therefore a slight modification has to be made by having a middle row of bags placed crosswise and closing off with two bags, 149, 150, placed lengthwise over them.

It may appear at first sight that this is a rather complicated method of loading, but it will be found to repay amply any trouble that is taken, as not only is it well nigh impossible for any bags to fall off the truck, but the finished truck presents a neat appearance and its slope facilitates the placing of the tarpaulin over it. It will be found that with a little direction at first the boys will soon get into the way of loading, and will load as rapidly as by any other method. It is probably best to keep two boys in the truck to receive the bags from the others and place them in position.

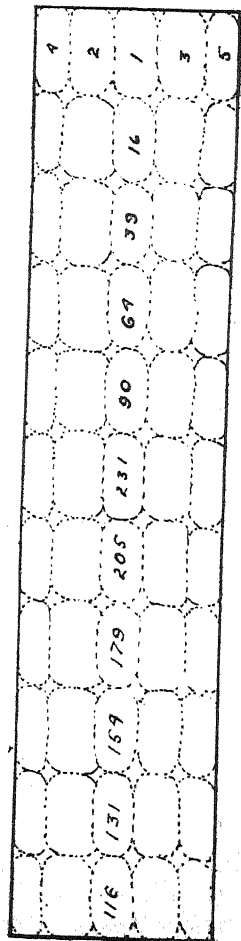
These systems of loading have been evolved from suggestions made originally by Mr. White, of Messrs. Wightman's, Ltd., with the assistance of the District Traffic Superintendent, to whom thanks are due, and have been approved and adopted by the railway authorities.

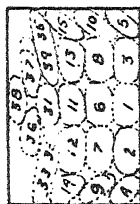
The accompanying diagrams have been prepared in the office of the Irrigation Engineer, Department of Agriculture.

Capacity 278 Bags

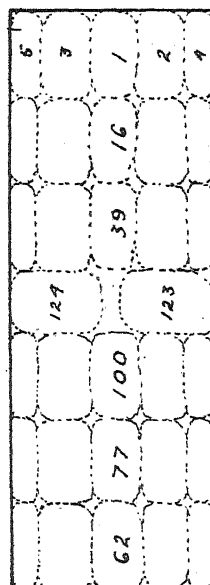
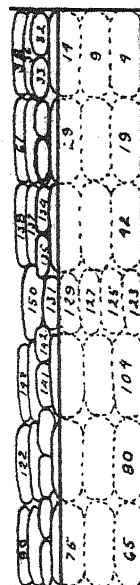


Start loading from one
end and load bags 1 to 15
then load from the other
end bags 16 to 278



Capacity 150 Bags

*Start loading from one end
and load bags 11061 then
load from the other end
bags 62 to 122 then fill
the centre with bags 123 to 150*

Load 30000lbs

Florida Beggar Weed

(*DESMODIUM TORTUOSUM*).

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

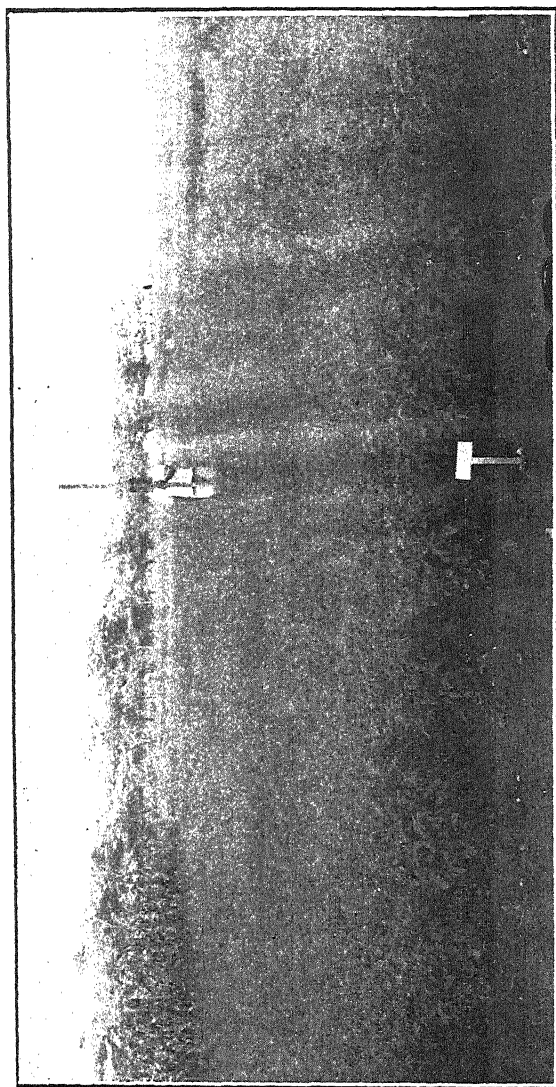
For some time now the Department of Agriculture has recommended beggar weed as a valuable perennial leguminous crop suitable for green soiling (*i.e.*, cutting and feeding green) or for grazing. Lucerne has been found a difficult and uncertain crop to establish in Rhodesia unless the conditions for it are especially favourable and ample water for irrigation is available. Even given these, the land for lucerne generally needs to be trenched and terraced, and frequently requires lime, wood ash or other manures or fertilisers. Beggar weed, on the contrary, has for many years given excellent results on the Experiment Station, Salisbury, with or without irrigation and without any special soil treatment. So much is it at home under Rhodesian conditions that it seeds profusely and volunteers freely in any land adjacent to an established stand. It germinates easily, and is extremely hardy when young, very few plants burning or wilting-off even during droughty spells. Seed is sown in drills or broadcast as for lucerne.

The stalks of beggar weed, as it matures, become hard and woody, and for this reason it should be cut or grazed frequently, and each time before it becomes too mature. This fact renders it more suitable for green soiling or grazing than for hay. Beggar weed is in no sense a rival to lucerne. Where the latter can be grown it stands supreme, but where lucerne cannot be grown without great difficulty, as on many farms in Rhodesia, beggar weed forms as yet the next best substitute.

On the Salisbury Experiment Station during last season one plot of beggar weed sown down in January, 1920, was cut as follows:—

- 1st cutting, 6th October, height 12 inches.
- 2nd cutting, 20th November, height 18 inches.
- 3rd cutting, 30th December, height 21 inches.
- 4th cutting, 16th February, height 21 inches.
- 5th cutting, 20th March, height 18 inches.
- 6th cutting, 8th June, height 9 inches.

Growth on the earliest cutting was hastened by irrigation—one watering early in September. A second watering was given on the 10th October, after which the crop was entirely dependent upon the rainfall. The sixth cutting yielded 1,170 lbs. green fodder per acre, and since this was the shortest growth of any, it may safely be assumed that the total yield of green forage per acre for the six cuttings was not less than 12,000 lbs.



Beggar Weed, Agricultural Experiment Station.

The following reports on beggar weed, grown from seed supplied under the usual terms of co-operative experiments, bear out the opinion already formed of this crop. Mr. G. W. Davis, N'Gombe Farm, Sinoia, Lomagundi district, sowed about 1 lb. of seed broadcast on a quarter of an acre on 3rd December. Half the plot was manured with farmyard manure and the remainder was untreated. The soil was a poor sandy loam. On the part manured, as was to be expected, the crop did much better than on that unmanured. The first cutting, taken on 20th February, yielded three Scotch cart loads of fodder, while the second cut, taken 10th March, gave one Scotch cart load. The weather conditions immediately following sowing were very unfavourable, as a long drought followed, and no saturating rains fell until the middle of January.

Several neighbouring farmers inspected the crop, and considered it the most promising fodder they had seen. Mr. Davis states that, green or as hay, it is the best food for dairy stock he has found. On 14th July it was still green, and it was difficult to keep the cattle away from it. Mr. Davis hopes this season to put in 10 to 20 acres of beggar weed.

Mr. A. R. Rutherford, of Rutherdale Farm, Shamva, sowed half a pound of beggar weed seed in three rows, each a hundred yards long, on 22nd January. The first cutting was taken two months later, and since that date it has been cut and fed daily to a bull and a horse. Mr. Rutherford states that he has had no trouble with it, and considers it a very valuable fodder, of which he hopes to increase the acreage next season. The last cutting was taken early in June, and since the crop is not irrigated, and since the soil is hard or clayey in nature, no further growth has been made since then.

Further reports from farmers who have had experience of beggar weed will be welcomed.

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc.

The following extract from the annual report of His Honour the Administrator of South-West Africa for 1920 contains certain remarks of exceptional interest to Rhodesians and some authoritative expressions of opinion which have a direct bearing upon our problems. We quote: "Apart from the diamond industry, this country's future depends mainly on the raising and exporting of stock. The figures relating to the export to the Union are given in the following table:—

	Cattle.	Sheep.
January	2,025	6,430
February	822	4,038
March	1,035	11,598
April	1,028	18,923
May	1,143	12,123
June	955	16,386
July	1,254	14,904
August	1,864	8,119
September	1,729	9,725
October	2,335	5,079
November	1,745	1,693
December	462	45
	16,397	109,063

"The value of the cattle exported is somewhere in the neighbourhood of £175,000, and of the sheep about £120,000.

"It is considered, however, that this country cannot look to the Union as a permanent source of income from the exporting of cattle and sheep, since, in the ordinary way the latter is well able to meet its own requirements; and it is probable that some cold storage scheme will have to be undertaken with a view to exporting overseas. There is an export tax of 20s. per head on slaughter cattle and 2s. 6d. on sheep. The tax is collected by the Railway authorities on our behalf, payment being made when the animals are actually consigned.

"The industry has been handicapped by the trying journey to the Union, and I have been informed by reliable authority that an ox loses as much as 200 lbs. in weight through this journey. Everything possible is done in the way of inspection, resting, feeding and watering stock, to prevent this. The high railway charges also handicap the industry. It is hoped that the railways will be able to reduce these in future.

"In October the Senior Veterinary Officer visited Pretoria and arranged that our cattle should be permitted to go to open markets in the Union under certain conditions. A co-operative movement has been started with regard to the exporting of cattle, and it is hoped that this will assist matters considerably."

* It will be noted that the number of cattle exported from the South-West Protectorate during the year 1920 was 16,397, as against 24,142 head of slaughter stock from Southern Rhodesia, but the value is £10 13s. 6d., compared to our £9 15s., indicating probably a heavier average weight, though from what we know of the country, probably also a greater average age.

A most important statement, especially considering the source from which it emanates and the close political connection between the two territories, is made that South-West Africa cannot look to the Union as a permanent source of income from the exporting of cattle. This being so, it makes it the more imperative that we in Rhodesia should take early steps also to find some other outlet than the Union for our surplus of cattle.

If it is necessary for South-West Africa with some 600,000 head to provide for oversea export, how much more is this true of Southern Rhodesia with over 1,600,000 head? If it is possible for South-West Africa it is surely feasible for us, certain contrary opinions by interested parties notwithstanding.

An interesting fact is that in South-West Africa there was a tax of 20s. per head on slaughter cattle exported, which we believe has since been suspended, but which just counter-balanced the difference in value between South-West and Southern Rhodesian cattle.

The comments in regard to the trying nature of the journey and the consequent loss in weight are applicable with even more force to Rhodesia, whilst the references to the opening of the markets to a greater extent than has yet been accorded to us are also noteworthy. Finally it will be observed with interest that reduction of railway rates and co-operation for the sale of cattle are, as here, matters of concern to our neighbours in the South-West.

Corresponding to the export tax in South-West Africa, there is a tax of five shillings per head imposed by the Government on all cattle except unweaned calves exported from the Bechuanaland Protectorate into the Union. If such a levy were made in Rhodesia and the sum devoted to the pastoral industry, much good might be done.

In addition to slaughter cattle, it is now permissible to export pedigree stock, grade bulls and cows and working oxen from Southern Rhodesia to Portuguese East Africa. The conditions governing exportation are given below:—

REGULATIONS REGARDING IMPORTATION OF CATTLE INTO PORTUGUESE TERRITORY FROM RHODESIA.

4.—(CATTLE: *Pedigree Cattle* (i.e., Entered in a Stud Book).

(a) Application for permission to import shall be addressed to the Director, Veterinary Department, Beira, and shall be accompanied by the following particulars:—

1. Applicant's name and address.
2. Description of animals: breed, sex, name and number in stud book, country of origin.
3. Name of seller.
4. Area or farm and district where the animals at present located.
5. Name and address of purchaser.
6. Government veterinary certificate of health and tuberculin test certificate.

Grade Bulls and Cows.—Application to import to be accompanied by the following particulars:—

- (a) Number and description of animals, farm and district in which located, name of seller.
- (b) Government veterinary certificate of health.
- (c) Certificate from owner as follows:—

"I..... residing on the farm
..... in the district of.....
do solemnly and sincerely declare that the.....
(number in writing) animals enumerated below have been
in my possession for three months prior to date hereof,
and that during that period they have not been in contact
with or subjected to quarantine for any disease specified
in Section 4, Diseases Amongst Animals Ordinance,
Southern Rhodesia."

These animals will be subject to inspection at frontier.

Working Oxen.—Application to be accompanied by the following particulars:—

- (a) As for grade animals.
- (b) As for grade animals.
- (c) As for grade animals.

The following restrictions are imposed:—

(1) No farmer shall be allowed to import working oxen without the following particulars from the Commandant of the district:

- (a) That the oxen the farmer possesses are insufficient for cultivating his farm.
- (b) That during the last 12 months he did not dispose of working oxen which were fit for work.
- (c) That the farmer possesses a dipping tank.

These animals will be subject to inspection at the frontier.

(2) No sale of cattle from the farm on which imported oxen have been allowed may take place within 6 months of the date of the said importation.

Arrangements for export of cattle to Northern Rhodesia and the Congo are being made, and it is hoped that the present embargo may shortly be alleviated.

Meantime we read that in the Union objection is being taken to the importation of cattle from Southern Rhodesia to certain quarantine markets in the Transvaal. There is much loose talk of our cattle swamping their markets and so on, in which connection it is interesting to observe that no such objections were raised last year when our exports to the Union were three times as great as they are to-day. The customs returns for the first six months of the current year show an export from Southern Rhodesia of 3,731 slaughter cattle, against 12,297 head for the corresponding period last year.

The present position of the cattle industry of Southern Rhodesia—fully realised by those most concerned—is that there is a steadily piling up surplus of the finished product, slaughter cattle, beyond our present outlets, and that the existing opportunities for export are inadequate to meet our pressing need for a vent for our ever-increasing herds. This impending glut is the very outcome of our prosperity, and not the consequence of transient circumstances. It is therefore necessary to find a permanent solution. The progress is not only in numbers but also in quality and in early maturity. It is recognised that there is still a large proportion of compound and canner cattle, but every

generation and every year is seeing a larger and larger proportion of improved stock, and there is to-day quite a considerable proportion of freezers and chillers available.

Our exports are not only failing to keep pace with our natural increase but are actually diminishing. There is consequently a surplus piling up which is of a perishable nature and must find an outlet some day. This congestion is telling unfavourably on the price of stock and hence on that of land and on the spending powers of a large section of the community, and must therefore materially affect the prosperity of the country.

The problem of the sale of the slaughter stock has been discussed by our cattlemen at meetings recently held at Bulawayo, Victoria, Salisbury, Umtali and elsewhere. Some propose to utilise the representative farmers organisation, the Agricultural Union; others regard it as essentially a matter for the Cattle Owners' Association, and others again suggest that it be taken up by the Meat Producers' Exchange in expansion of their present activities on the Rand and through southern ports. So far, however, no precise programme has been framed, and without the intervention or establishment of some commercial concern for the express purpose of handling our cattle, it is difficult to see how progress can be made. To reach European markets, export of frozen beef is indicated, but this entails the establishment of freezing works with all the highly-developed sidelines incident thereto and the commencement of a complex manufacturing and commercial business, which is hardly a matter within the province of the farmer or stock raiser, and one really demanding special knowledge and much capital. We must distinguish between Rhodesia's permanent need and the present lack of demand for beef which accentuates our difficulties. Even in the Union, where the facilities for handling meat at the ports are in excess of requirements, there is a difficulty in disposing of frozen meat overseas, but this seems chiefly due to transient economic conditions. After all, the general inadequacy of the meat supplies of the world is recognised and the position seems rather to be one of inability to purchase at all rather than of a sufficiency of meat in the principal consuming countries. Even if freezing works were started here to-day, it would be some time before they were in a position to deal with supplies, and it is to be hoped and reasonably to be expected that ere long political developments will so have adjusted economic conditions that reliable markets will be available to us throughout Europe. In any event, it seems high time this subject was well ventilated with a view to something being done.

THE WORLD'S MEAT FUTURE.

By A. W. PEARSE.

Published by Messrs. Constable & Co., Ltd., 1920.

At a time when attention is being directed to the establishment of outlets overseas for a superabundance of cattle, a book has opportunely reached us which deserves the attention of all interested in this subject, and directly or indirectly that means most people in Rhodesia.

Under the title of "The World's Meat Future," Mr. A. W. Pearse, the editor of the *Pastoral Review*, the leading Australian farmers' paper, gives an account of livestock in all the principal pastoral countries of the world. Mr. Pearse has collected and concentrated a mass of most valuable and interesting information and presents it in a most readable form for our instruction.

The writer addresses himself to "stock owners all over the world who are anxious about the future of the stock raising industry," but happily the results of his studies lead him to hold "that for many years cattle and sheep raising are going to be the most profitable of all industries." This is a pleasing verdict and a happy augury for Rhodesia.

The book teems with facts, figures and views which are of significance to us in the present critical stage of our pastoral development. Certain of these may here be quoted with a view to indicating the wealth of ideas which the reader will find in these pages. The world output of frozen and chilled beef, mutton and lamb in 1917 was estimated at 965,000 tons, of which all except 386,000 tons went to the markets of the United Kingdom.

The markets for such meat are rapidly expanding, notwithstanding temporary fluctuations, and particularly in foreign countries, whilst the means of preparation and transport are rapidly developing—may we add except in this country, as yet?

After giving a list of the 32 chief stock producing countries of the world, including Rhodesia but omitting all Europe from the category, the author makes the following significant comment: "With the introduction of good stud animals to those countries which are yet in their undeveloped condition, the installation of numerous dips, and with stable governments, in a very few years they could most of them be brought to the meat-exporting stage. The past experience in Argentina and Uruguay, and the present experience in Brazil, are sufficient to show the more backward countries what they may look forward to under modern business methods."

The opinions of the author in regard to railway questions are based on exceptional experience of the question and knowledge gained as editor of the great Australian pastoralists' organ, and his very definite conclusions will come as a surprise to many Rhodesians. We therefore again quote him: "Australia is a vast country, with magnificent grasses for stock, and, with a good supply of labour, would be hard to beat by any country in the world. The State ownership of railways is a drawback, however, as under this system, unless continual British loans are forthcoming, railway enterprise in opening up new country is stagnant. Again, democratic governments never think of constructing railways unless there are sufficient votes along the proposed line to encourage them to do so. 'Tis votes that count all the time under State ownership of railways. Nearly £500,000 per annum is given the highly-paid railway and tramway employees in New South Wales alone in the shape of free passes and concessions. This is passed on to the producer in higher freights. Another drawback is that it is almost impossible to get Government employees to take care of live stock,

and they consequently depreciate enormously between their fattening grounds and the meat works on the sea board. The Australian railways are years behind the times in the matter of refrigerated wagons, and to all appearance nothing will wake them to the necessity of equipping their systems with means of bringing meat down to the sea board dead rather than alive, also to the importance of making country life more pleasant by transferring perishable produce to the out-back towns in refrigerated wagons as is done in Canada and America." The same point is emphasised elsewhere in the book and appears to be a sore subject with Australian cattlemen. There are quite a few points in this book which our own politicians might study with advantage.

We read with amazement of the disabilities of the cattle industry in Australia through the labour and railway policy. "In some countries private railway companies offer reduced rates for the carriage of stud animals as an encouragement to breeding which will bring business to the railways. The State-owned railways of Australia charge more for stud stock—sometimes as much as ten times more than ordinary rates."

A parallel to the position of the meat industry in Southern Rhodesia appears to exist in Western Australia, and its experience may be taken as a warning to us. It is considered that the cattle industry in this portion of the Commonwealth will not be in the south but "in the tropics, and very largely in proportion to the development of cold storage."

The need is urged for the establishment of freezing works at Derby "to terminate the day of cattle shipments southward and then waste of 100 lbs. per bullock, and to ship away the product of the country in cold storage or in tins, with the tallow and hides."

It is of interest to learn of the bright prospects of Brazil as a ranching country than which "no other country is so lavish in Government assistance to pastoralists or farmers," and land can be bought from 1s. 6d. to £3 per acre according to situation. "A bonus of £27 to £34 is given for every stud cow or bull imported into the country. Implements, fencing material and other things required by settlers are admitted duty free, and in each of the twenty-one States of Brazil there is a Government stud farm where stud bulls and stallions are kept for the free use of farmers."

"Every facility is given to encourage occupation of the land. The freehold title is made as easy as possible to obtain. Anyone wishing to secure land makes application for Crown lands available, and the matter is put through with as little delay as possible."

In regard to Mexico, which resembles in some respects Southern Rhodesia, we find it stated:—

"As to the price of land, it is very varied, there being, as in all countries, good, bad and indifferent. Land that will carry a bullock to 10 acres can be bought, fenced and improved at from 6s. to 7s. an acre, according to its location to railways or large cities. Unimproved land of about the same carrying capabilities, but further back, can be bought at from 2s. and upwards, while some parts sell as low as 6d. an acre in large tracts of poorer quality. Irrigable lands are much higher, running from £6 to £10 an acre.

The cattle undoubtedly showed a great advance, and the sale which followed has distributed a lot of valuable stock amongst new owners and benefited sellers and buyers alike. This great success will establish the Salisbury show as a cattle breeders' rendezvous second only to Bulawayo. The fact that several months separate the two shows is all to the good, since it prevents the one being a mere repetition of the other and gives time for fresh show animals to enter the lists and for further supplies of selling stock to accumulate. On the other hand, visitors from the Union would attend both shows if they were close together, but after all, the shows are run for the benefit of the farmers of this country, not of our visitors, though they are also made very welcome.

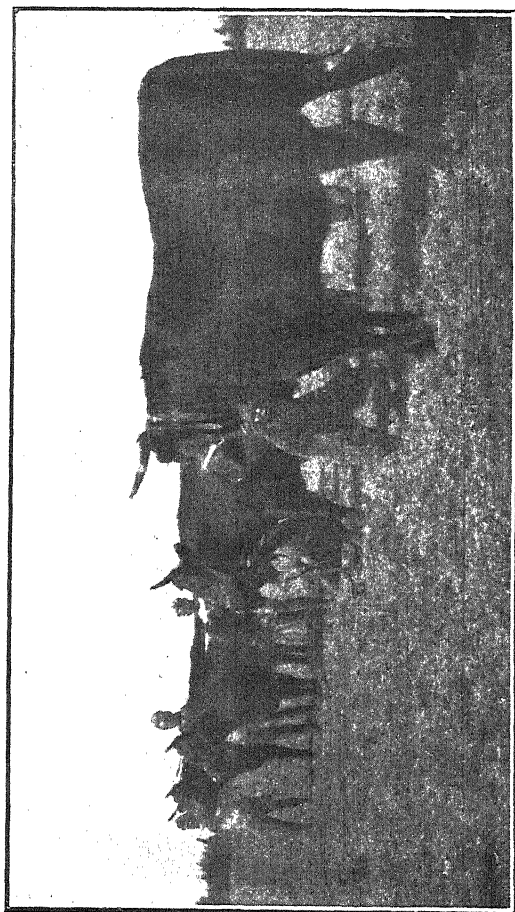
Maize.—The maize exhibits, taken as a whole, were excellent, and as usual filled the visiting judges who had not previously seen a Rhodesian maize show with admiration. Mr. Walter Pepworth, the well-known maize grower and judge of Natal, freely admitted that he had never before seen so splendid an exhibition of maize, and Mr. Horsfall, who judged the shelled grain, was equally eulogistic.

Exhibits in the class for 500 ears breeding Hickory King were hardly so numerous as last year, and the ears were perhaps hardly as big and weighty. Messrs. Glanfield & Rattray took first prize in this class. The 100 ears breeding Hickory King class was, however, very strong and competition extremely keen. Mr. H. N. Huntley, whose exhibit was awarded first prize in this class, put up a magnificent collection of ears of great weight and size. In the 500 ears class for Salisbury White, Mr. D. W. Bean, of Shamva, was awarded first prize and the Department of Agriculture second prize. The Grand Championship and Reserve Championship for the best 500 ears exhibited were won for the first time in the history of the breed by Salisbury White maize, Mr. D. W. Bean's magnificent exhibit taking premier honours and the Department of Agriculture the Reserve Championship for a somewhat lighter though perhaps rather more uniform collection of ears. It is extremely satisfactory to record the marked improvement taking place in this breed and the much greater uniformity in type which is being brought about by careful selection. Entries in the class for 500 ears Louisiana Hickory were not numerous, but the quality was very good throughout, the main fault being a slight lack of size in some of the ears. Competition was again very keen in each of the 100 ears classes for Louisiana Hickory, Salisbury White and Any Other Variety. In the first-named, Mr. Kneiser, of Banket, staged a hundred ears of outstanding merit, while in the Any Other Variety class Mr. J. F. Templeton, also of Banket, put up a particularly fine collection of Texas Hickory which were remarkable for great size, weight and uniformity. So closely did the two types conform in general appearance that this exhibit might in the opinion of one or more of the judges have equally well been staged as a Salisbury White, and the differentiation between these two breeds is a matter which must shortly call for the attention of the Maize Breeders and Growers' Association.

The ten ear and single ear classes were well supported, with an average of ten to twelve entries in each class. In the classes for five



"County Magistrate," winner of Milne Trophy, Salisbury, 1921.
Owned by Messrs. Drummond Forbes & Freeze, Bulawayo.



Mr. C. C. Macarthur's grade Shorthorn oxen, exhibited at Salisbury and Johannesburg.

bags of shelled grain entries were as usual very numerous. In the first-named class, Mr. Kneiser obtained first place and Grand Championship. A particularly pleasing feature of the maize entries as a whole was the fact that in several instances new growers who had not previously exhibited not only did so but were successful in carrying off awards.

Tobacco.—The exhibits of tobacco constituted the finest display ever seen in South Africa. The number of entries showed a considerable increase over last year, and the quality of the exhibits was generally of high standard. The leaf exhibited included both the Virginian and Turkish types. The exhibits of dark and medium leaf were not, on the whole, of as good quality as last year, but the prize lots in these classes were of deserving merit.

In the bright or cigarette classes the competition was very keen and the exhibits were of excellent quality. For the best 10 lbs. of leaf in this class the first prize was awarded to Mr. A. C. Henderson for an exceptionally fine display of leaf of the "Hickory Pryor" variety. In the competition for the best bale of Virginia cigarette tobacco, Mr. Henderson again captured first prize, with an exceptionally attractive exhibit. For the best bale of Virginia medium bright tobacco, Capt. F. Smith received first prize for an exceptionally fine exhibit.

The commercial exhibit of Virginia tobacco attracted the attention of growers, and the competition in this class was therefore very keen. This class called for one bale each of not less than three distinct grades, and the leaf had to be graded, tied and baled on the farm from a crop of not less than 5,000 lbs. The first prize of £50, as well as the Silver Floating Trophy, value 50 guineas, was won by Mr. A. C. Henderson. The attractive manner in which the tobacco was packed and the excellent keeping condition of the leaf clearly demonstrate that farm grading of tobacco can be successfully carried out by growers in Southern Rhodesia. In the class for the best assortment of Virginia leaf the competition was very keen. The first prize went to Capt. F. Smith, who is to be congratulated on his success in the tobacco section, having been awarded no less than four second, two first and four special prizes, including the Floating Trophy to the most successful exhibitor in the growers' classes. As Capt. Smith has only been engaged in tobacco cultivation for one season, his success should be an incentive to other new growers.

In the classes for Turkish tobacco, all three firsts went to Mr. M. Pevsner, the well-known grower from Bulawayo. Mr. Pevsner also staged a most attractive and educational exhibit showing the several stages in the growing and handling of Turkish tobacco. He is to be congratulated on the success of his display, for which he was awarded a special prize.

The Rhodesian Tobacco Co-operative Society also displayed in an attractive manner leaf packed ready for market. The display included bales and hogsheds of leaf, and the neatness, general appearance and quality of the exhibit elicited favourable comment from all those interested in the tobacco industry.

There was only one exhibit of manufactured tobacco, but this deserved special mention, as the whole of the display was manufactured

from Rhodesian leaf. The exhibit, consisting of dark and bright cut-plug, shag, golden flake, Cavendish and Raleigh mixture, was staged by the Raleigh Tobacco Co., Capetown. The products were of excellent quality and were attractively displayed. This company uses only Rhodesian tobacco for manufacturing purposes, and the high quality of the manufactured tobacco exhibited is a tribute both to the company and the growers in Rhodesia.

Produce.—Until the present show it was common and well-merited criticism of our Agricultural Society that sufficient encouragement was not given to the production of high-class farm produce. To give more encouragement to this branch of farming, the Society very liberally increased the value of the prize money. For the best bag of seed wheat the first prize offered was £10. This had the effect of producing 13 entries, and in keen competition Driefontein Mission, Umvuma, won with a splendid sample of Gluyas Early. It was a most pleasing feature to see such excellent samples considering that the wheat crop is reaped during the latter part of October and November, so that the wheat grower, to enable him to compete at the Salisbury show, must store and protect his grain from weevil for eight or nine months. There were 17 entries in the sunflower seed section, and the judges had a hard task in making their awards. In ground nuts there was a record entry, no less than 19 exhibits, and there was not a bad exhibit amongst the lot. In the different classes for beans there were no less than 34 entries, and these gave the judges another difficult task. Both table and seed potatoes were well shown, all being free from disease and well selected. Pumpkins were well represented and some excellent specimens were staged. Excellent samples of oat hay and teff were to be seen, but more in number could have been expected, though the quality was excellent.

Dairy Produce.—There was a good display of dairy produce of excellent quality, both in the household and creamery classes.

The classes under the heading of Home Industries were particularly strong and competition was keen.

In the butter classes flavour might have been more pronounced, but until we get more irrigation schemes and a greater production of green feed this will continue to be a deficient element in Rhodesian cream (and butter) produced in the winter months. Some of the samples were weak in body, no doubt due to lack of control of temperature when the butter was made or to the butter having been made some days previous to the show. As a whole, the butter was well made; the salting was satisfactory and the "make-up" pleasing to the eye. Some of the butter paper, however, was of a coarse quality. This type of paper should never be used for show purposes, as the judge is apt to be prejudiced against the exhibit by the use of a blackish, opaque, heavy-looking paper. The first prize for 4 lbs. of fresh butter went to Mrs. J. Dennis.

In the cheese classes exhibited in the Ladies' Industrial Hall there was a fair display, although only three of the exhibits came from Rhodesia. It was disappointing to note that there were only two entries in the sweet milk class. This variety of cheese should be made on practically every farm, and it is to be hoped that there will

be more entries in the future, as the cost of a plant is trifling and cheese can be stored and ripened most successfully during the winter months. The first prize went to the Model Dairy, Bulawayo, and a special prize was awarded to the Salisbury Cold Storage. It is pleasing to note that the first prize cheese was greatly appreciated and commended by T.R.H. Prince and Princess Arthur of Connaught at the show luncheon. In the Cheddar cheese class there was again competition from the Union, the first prize going to Mr. G. W. Young, jnr., Franklin, and the second to Rocky Ridge Cheese Factory, Kokstad.

Creamery Classes.—The handsome cups awarded for export classes in cheese, butter and bacon by Messrs. Lovell & Christmas, London, attracted considerable competition from the Union.

In the export butter class the cup was awarded to the Natal Creamery (Maritzburg branch), and it is worthy of note that our local creamery at Gwelo obtained second place with a comfortable margin against other competing Union creameries. This is certainly encouraging, and it is to be hoped that Rhodesian farmers will not relax their efforts to keep their cream up to the high standard required for butter making for the export trade.

In the cheese classes the first prize and cup were awarded to the Rocky Ridge Cheese Factory, Glendower branch, Griqualand East. This factory has taken premier honours at the London Dairy Show and at the Royal Show, England, besides gaining the gold medal at the South African Exhibition recently held in Holland. In face of such competition our local exhibits did excellently. Mr. Harley's cheese was penalised because it was too new. It should be remembered that cheese matures slowly in winter and that no cheese of a large size should be exhibited at Salisbury show until it is at least ten weeks old. Small cheeses, 10 lbs. in weight, should be kept six to eight weeks in winter before being used, whereas in summer they can be used at about five weeks.

Bacon and Hams.—In the home industries class for bacon the first prize went to Mrs. D. W. Bean, of Shamva. In the export class there was a deplorable lack of competition, but the only exhibit, by the Farmers' Co-op. Industries, Ltd., was of fine quality, suitable for the export trade, and it was awarded the Lovell & Christmas Cup.

The Milking Competition.—Nine cows were entered to compete for the handsome prize of 20 guineas presented by Mr. B. I. Collings. Only five, however, competed, and the prize went to Mr. W. R. Waller for the creditable performance put up by his grade Red Poll cow "Peggy." Details of the results will be found in the accompanying table. The competition was interesting in demonstrating how greatly cows of the same breed, under similar conditions of feed and environment, differ in their butter fat tests. Only by selection and the use of bulls from dams of high butter fat production can we hope to raise the standard throughout the country. By consistent testing and by the keeping of records we can have some degree of certainty that the bulls we use are causing increased production from our dairy herds, but with no such records our efforts are, as it were, a leap in the dark. It is to be hoped, therefore, that breeders of dairy stock will support the scheme of milk recording which is outlined in the present issue.

MILKING COMPETITION, SALISBURY SHOW, 1921.

Time of milking.	Total lactation days.	Lbs. of milk.	Specific gravity.	Percentage of butter fat.	Percentage of solids not fat.	Lbs. of butter fat.	Lbs. of solids not fat.	Points for lactation.	Points for quantity.	Points for butter fat.	Points for solids not fat.	Deductions—fat.	Deductions—solids not fat.	Corrected points.	Grand total points.	Name of owner.	Name of cow.	Position.	Breed.
7 a.m. 5 p.m.	181	14.7 11.7	1.031 1.033	3.5 3.2	8.60 9.05	5145 3744	1.2642 1.0588	14	14.70 11.70	10.29 7.48	5.06 4.23	... ...	... ...	44.05 23.41	67.46	W. R. Waller	Peggy	1st	Red Pc
7 a.m. 5 p.m.	200	14.5 10.4	1.031 1.032	2.9 2.5	8.50 8.65	4205 2600	1.2325 89.6	14	14.50 10.40	8.41 5.2	4.93 3.60	10 10	... ...	31.84 9.2	41.04	W. R. Waller	Nancy	4th	Red Pc
7 a.m. 5 p.m.	...	15.5 13.2	1.030 1.033	3.5 3.8	8.35 9.20	5425 5016	1.2812 1.2144	...	15.50 13.20	10.85 10.03	5.14 4.86	... ...	... ...	31.49 28.09	59.58	J. Struthers	Coffee	2nd	Friesian
7 a.m. 5 p.m.	...	19.0 14.2	1.030 1.031	2.7 2.5	8.20 8.40	5130 3550	1.5580 1.2928	...	19.00 14.20	10.26 7.10	6.23 5.17	10 10	... ...	25.49 16.47	41.96	J. Struthers	Daisy	3rd	Friesian
7 a.m. 5 p.m.	...	10.5 11.7	1.031 1.031	3.0 2.9	8.5 9.0	3150 3393	8925 1.053	...	10.50 11.70	6.30 6.78	3.57 4.21	... 10	... ...	20.37 12.69	33.06	J. Pascoe	...	5th	South De

Enterprise Ploughing Demonstration.

"Farmers are not so concerned nowadays with the breaking power of ploughs as with their ability to do more intensive work, such as the turning-in of growthy crops for green manuring. . . ."

These views were communicated by the members of the Enterprise Farmers' Association to Messrs. Kernick and Martin, of the Anglo-African Trading Co., who proposed holding a ploughing demonstration in the Enterprise district in the latter end of March.

It was decided to conduct the trials at Mr. H. B. Christian's farm, where there were more facilities at hand for this purpose than could be found on any other farm in the district. From the time of starting farming at Ewanrigg several years ago, Mr. Christian has always had in the front of his mind the preservation and augmentation of soil fertility, and the bringing back of older and impoverished land to a state of productiveness not only equal to but *far greater* than it possessed before.

It may be said here that Mr. Christian has brought Ewanrigg into a very fine state of cultivation, and his results are not only remarkable but most encouraging; easily seen and generously explained. As the chairman of the Enterprise Farmers' Association remarked recently, "He hardly required to attend the excursion to the Gwebi Experiment Farm: he had an experiment farm at his own door, tackling just the problems they wanted tackled, and doing it well!"

Thus it came about that there were several areas of velvet beans and sunn hemp for Mr. Kernick to try and turn under, and (owing to late rains) on a day when the land was at its worst for such a trial; moist and adhesive, and clammy with the heavy mass of vegetation above.

The ploughs tried were the new Koodoo 14 in. gang and the Stag, also the four-furrow Deere disc plough. It seems to be generally conceded now that disc ploughs are not so suitable as mouldboards for the purpose of turning in green crops; they require more speed than oxen can give. The object of the test was to find the most suitable plough for turning in heavy green manuring crops. The lands on which these ploughs were tried, Mr. Christian says, were planted to velvet beans sown broadcast early in November. The previous season the land had been kraal manured, with the result that there was a tangled mass of velvet beans and weeds up to five feet in height. It was particularly difficult to get the shares to scour, owing to the condition of the soil already referred to. This made Messrs. Kernick and Martin's task very much more difficult, because a clean share would have thrown off the furrow so much better.

The Koodoo plough was of the latest type imported, cutting 14 inches instead of 12 inches as in the old type. The mouldboards were of the new pattern, which have been decided upon as the best general purpose style, and were fitted with extension pieces for the better turning over of the furrow slice. These mouldboards can be fitted to any mouldboard plough sent out by the Deere Company.

The Stag was of the old pattern and similar in all respects to the one which was considered to have done the best work at the "ploughing in of green crops" demonstration at Ewanrigg in 1918, when seven different makes of ploughs were tried.

The ploughs were first tried with the crop standing, that is, without being first cut up with the disc harrow. The rank growth of vine and weed, and the clammy sticky soil, made the test extremely trying. The Koodoo did the better of the two, and very good work, turning in the vegetation fairly well considering that, without ploughing too deep, there was hardly space to accomodate the stuff in the furrow, even under best ploughing conditions! It was found impossible to use chains to help, owing to the sticky nature of the ground. A disc harrow was then put on to cut up the rank vegetation, but in spite of three heavy men weighting it, it was unable to properly cut the vines owing to the ground beneath being too soft and sticky. It, however, laid the crop flat, and on the whole the ploughs were able to do better work. The Koodoo still led; in fact, considering all the conditions, it was marvellous that it was able to turn so much crop under. The disc plough was unable to work in the ground, though with drier conditions it has done excellently in turning in green crops, due largely to the scrapers being "mouldboard" shaped.

In the tremendous growth of sunn hemp, standing away up over one's head, it was found that the weather conditions were impossible for any plough, although it is well known that this crop is one of the easiest to work with—the absence of clinging vine making all the difference. Mr. Christian had a lot of experience with it last year, and turned it in quite out of sight at any height of growth.

It is all-important, in the maintenance of soil value, that the thought and care expended on suitable rotations and crops be not nullified by inadequate mechanical work later, such as imperfect ploughing in, bad tilth, etc. In this connection it would be difficult to over-rate the services of Mr. Kernick, whose knowledge of implements is second to none in this country, and whose advice and help is always worth having.

The demonstrations took all the forenoon and part of the afternoon. Messrs. Blackshaw, Walters and Mainwaring, from the Department of Agriculture, were present, bringing with them all their customary enthusiasm and geniality! There were also present some dozen farmers from the district and several new settlers. With characteristic hospitality Mr. and Mrs. Christian provided lunch at the house, which was heartily enjoyed and appreciated by everyone.

Report of the Chief Veterinary Surgeon

OF SOUTHERN RHODESIA FOR THE YEAR 1920.

Presented to the Legislative Council.

I have the honour to submit my report on the work of the Veterinary Department for the year ending 31st December, 1920. I am indebted to the Assistant Chief Veterinary Surgeon, Mr. C. R. Edmonds, for writing the sections "Cattle Cleansing Ordinance" to "Tuberculosis" inclusive.

African Coast Fever.—A schedule is attached showing the centres at which this disease manifested itself during the year and the mortality. Although fourteen new centres of infection are shown, there were in reality only three fresh outbreaks of disease due to unknown and unsuspected infection, viz., Quagga's Hoek, in Melssetter district; the Matopo hills, west of the Malundi River and adjoining farms; and Sauerdale, in the Matobo district. The three farms in the Mazoe district are, strictly speaking, part and parcel of the original outbreak on the farms Avonduur and Leopard's Vlei, and are not regarded as fresh outbreaks. The total number of fresh outbreaks is therefore three, with a mortality of 757, compared with eight and 798 respectively during the previous year. Whilst the number of cattle and the extent of the areas involved are greater than in the previous year, due entirely to the extensive spread of infection in the Matopos before discovery, the position generally has improved considerably, inasmuch as the disease was in evidence in three districts only, as compared with five in 1919. The incidence of the disease in the various districts will now be more fully dealt with.

Melssetter District.—Of the five farms in quarantine at the beginning of the year, four were released, no case of Coast Fever having occurred amongst the cattle thereon for at least fifteen months. On the farm Tarka, which forms part of the Tilbury Estate, a serious infection occurred in January, and resulted in a heavy mortality. This farm adjoins Mermaid's Grotto, also part of the Tilbury Estate, where an outbreak occurred in March, 1919. It is now certain that both these outbreaks had their origin in unsuspected infection which existed on the eastern portion of Tarka. It appears that some cattle died on this area towards the end of 1918, that the remaining animals were moved to Mermaid's Grotto, and that on 6th March, 1919, a week or two after their arrival, two cases of Coast Fever occurred. The eastern portion of Tarka was kept free from cattle until the latter end of 1919, when a herd was placed on it, because grazing was short elsewhere. This herd had recently arrived from Umtali district, and as there had been no

Coast Fever on the farm whence they came, or any of the farms *en route*, there can be no question that they were free from infection on arrival at the Tilbury Estate. Within a few weeks, however, of their disposition on the eastern portion of Tarka, in January, 1920, a heavy infection occurred. This occurrence, together with the outbreak amongst the cattle moved from the same area to Mermaid's Grotto earlier in the year, shows clearly that the veld was infected in the latter part of the year 1918, and to the failure to detect it then may be attributed the heavy losses on the Tilbury Estate in 1920.

An outbreak occurred in December on the farm Quagga's Hoek, in the northern section of the district, thirty miles in a direct line from the nearest infection on Tilbury and at least fifty by any accessible cattle route. It is impossible to account for the origin of infection in this case, but it may be noted that in 1915 a severe outbreak occurred on this farm; 69 head out of 81 died in three months and those remaining were kept on clean veld for upwards of two years before being allowed to return to that on which infection had previously existed.

Gwelo District.—The mortality at the single centre of infection in this district, viz., the adjoining farms Clearwater and Northfield, persisted until June, a period of thirteen months from the discovery of the disease. It is satisfactory to be able to report that there was no manifestation of the disease elsewhere in the district.

Mazoe District.—At the original centre of infection, viz., the farms Avonduur and Leopard's Vlei, the mortality persisted until March, a period of ten months from the occurrence of the outbreak. During the year the disease was found on the adjoining farms Glen Divis and Rocky Spruit, and on Sleamish adjoining the latter. The degree of infection was mild, and the mortality relatively small.

Umtali District.—At the beginning of the year there was one infected centre, viz., the farm N'odzi, where a solitary case of Coast Fever had occurred in December, 1919. In January three animals were destroyed on showing a rise of temperature; *post-mortem* and microscopic examination proved negative. No further suspicious cases occurred during the year in the infected herd or elsewhere in the district.

Victoria District.—At the beginning of the year one infected centre existed, viz., the farm Morgenster, where the last death from Coast Fever had been recorded in February, 1919. All restrictions were removed at the end of May.

Matobo District.—After seven years' freedom from Coast Fever in Matabeleland, two outbreaks occurred in the Matobo district, the first amongst native cattle in the Matopo Hills in January, and the second on one of the sub-divisions of Sauerdale in June. In the former case a fairly large area was found to be involved, and everything pointed to the existence of the disease for a considerable period previous to detection. The failure to suspect it at an earlier date was largely due to the coincident prevalence of quarter-evil. If the extent of the area involved in the first instance, the large numbers of cattle thereon and in the vicinity, and the fact that the disease had been there for some time are taken into consideration, it is surprising that the subsequent

spread of infection has not been much greater and the mortality heavier. At the Sauerdale centre the infection was restricted to one herd on a well-defined area. There is no definite information as to the source of infection in either case, but there is some reason for associating the Matopo outbreak with cattle brought from the vicinity of the Hunter's Road outbreak in Gwelo district.

"Cattle Cleansing Ordinance, 1918."—This Ordinance was promulgated on the 27th September, 1918, and its provisions were applied to the major portion of the Territory on 1st December, 1918, by Government Notice No. 377, published on the 4th October, 1919. On the 17th September, 1920, by Government Notice No. 477 it was applied over a still larger portion of the Territory. During the present year it is hoped to extend its operations further, and soon to have no portion of the country inhabited by an appreciable number of cattle exempt from regular and effective dipping.

With a view of showing the extent of the progress that has been achieved during the two years that the Ordinance has been in force, the schedule attached to this report* has been prepared from the annual reports of Cattle Inspectors. This schedule deals primarily with "dipped" cattle. There are a certain number of "undipped" in every district; where the number is known it is given; where it is unknown the space in the column is left blank, and these figures are for the end of the year; so on the publication of the live stock census, which is also taken at the end of December, it will be seen to what extent the numbers correspond. It must be remembered that the census figures apply to the whole country, whereas the figures in the schedule do not do so; but in any comparisons that are made the whole number of cattle in the country is taken.

With regard to "farms" occupied by Europeans and natives, so far as occupation is concerned—this applies primarily in the sense of cattle—this is a farm occupied by European-owned cattle, whether a European is residing on the farm or not, or occupied by both Europeans and native-owned cattle or by native-owned cattle only. The word "farm" is not used in the ordinary sense of a single surveyed farm, but in the sense in which it is used in the cattle regulations of being a "place"; therefore it follows that if two or more farms adjoining are farmed together under one management, such farms are regarded as only one farm or place. Likewise a township is put in the list as a farm; so is a ranch, provided it does not extend into two or more native districts. On the other hand, if a farm has been sub-divided, and the various portions are in different ownerships and occupied by cattle, each portion is treated as a separate farm.

This explanation is necessary to avoid one making the error of simply deducting the total number of dipping tanks from the total number of farms and taking the result as representing the number of occupied farms without tanks; for example, in Chibi district alone there are twenty tanks and only five farms. With regard to the ideal of having a tank on every farm Melsetter comes nearest to this. The

* Schedule omitted.

schedule shows 101 occupied farms in the district possessing 103 tanks. As six tanks on one "farm" is the only instance in this district where there is more than one tank on a farm, the district comes very near the ideal so far as dipping facilities are concerned.

Cattle Dipping Tanks.—The total number of cattle dipping tanks in the country is 1,639, which is 294 more than in 1919. Great difficulty was experienced at times during the year in obtaining cement for the construction of tanks; neither were a sufficient number of masons available for erection, otherwise a larger number of tanks would have been completed during the year, but the work is going steadily on.

European-Owned Cattle.—The returns show that 796,608 European-owned cattle on farms and 2,942 on native reserves and unsurveyed land are being dipped, which indicates that more European-owned cattle were being dipped in 1920 than existed in the country in 1919, the difference being 121,042. It would be idle to contend that all these cattle are complying strictly with the provisions of the Cattle Cleansing Ordinance by being dipped regularly every seven days; the majority, probably a very great majority, are doing so; but owing to lack of a sufficient number of tanks making the distances to be travelled long, and for other reasons, a minority are not strictly conforming to the regulations, but the fact remains the cattle are being dipped.

With regard to the number 6,602 on farms and 370 of undipped cattle belonging to Europeans on native reserves and unsurveyed land, some of these animals are in areas at present exempted from the provisions of the Ordinance—Mount Darwin and Inyanga, for instance. Gwelo has the unenviable distinction of possessing the greatest number of undipped European-owned cattle.

Native-Owned Cattle.—It will come as a surprise to many to find that such a great number—158,526 on farms and 343,939 on reserves and unsurveyed land—of native-owned cattle are being dipped. The same remarks as to compliance with the provisions of the Cattle Cleansing Ordinance apply to the native as to the European-owned cattle. The total number of native cattle being dipped is 502,465, which is only 140,311 cattle less than the number of native cattle estimated to be in the country in 1919. Taking the entire cattle population of Rhodesia, it is found that in 1920 a total of 1,302,015 were being dipped, which is nearly as many cattle as there were in the country in 1919, the actual difference being only 29,269 head.

Regularity of Dipping.—With regard to regularity of seven-day dipping and the further number of tanks required, the schedule shows that on farms an average of 660 cattle are dipped at each tank; on native reserves the average is 1,700 odd head. Coming to the districts, it is found that in Melsetter one tank serves for an average 212 cattle; in Chibi a tank serves for 3,200 head. In Melsetter there is practically a tank on every farm; in Charter there is only one tank to four farms. These figures give a rough indication of facilities for dipping; but, of course, the details from which the summary is drawn reveal the position more clearly. Great differences exist in the districts in the number of

farms occupied solely by native cattle. Broadly, they are much more numerous in Matabeleland than in Mashonaland, which fact has considerable influence upon the proportion of the number of occupied farms to the number of tanks.

This is the first time that a return of this nature has been attempted. It is hoped with further experience in the collection and compilation of the information to furnish fuller details.

Tuberculosis.—In consequence of the diagnosis of the disease in two young bulls that were purchased from the British South Africa Company's Shangani Estate, the pure-bred herd of Shorthorn cattle on that estate were submitted to the tuberculin test. The test was commenced in September. By the end of the year upwards of 300 animals had been submitted to it, amongst which 35 were found to be affected with tuberculosis and 19 were regarded as suspicious. The tuberculous animals included a number of valuable cows and bulls. Some of these have been destroyed; others in calf have been isolated from all other cattle in a fenced-in enclosure a considerable distance from the homestead. When the latter calve, the calf will immediately be put on a foster mother, as statistics show that only one calf in about 300—even in badly-infected cows, which these animals apparently are not at present—is born tuberculous. It is hoped by this means to save some unborn lives valuable to the cattle industry. The suspected animals are being similarly treated in another enclosure. They will be periodically tested; those in which the existence of the disease is confirmed will either be destroyed or placed in the infected herd. None of the animals that have been put in either herd will be allowed to rejoin the main herd. After the cows in these herds have calved, their disposal will be further considered. All the cattle that have been sold out of the herd in the years 1919 and 1920, prior to the discovery of the existence of the disease, are being followed up and subjected to the tuberculin test. Early in 1921 it is hoped that every animal in the main herd will have been submitted to the test on at least three separate occasions. When all animals that re-act to the test or are regarded as suspicious have been weeded out to the satisfaction of this Department, the herd will be released from quarantine; but at the request of the owners it will be periodically tested, as will all animals entering or leaving it.

The actual source of the disease has not been traced, but little doubt exists that it was conveyed to the herd by some heifers that were purchased in the Union of South Africa, as, with two exceptions, all these heifers have been found to be affected. Cattle imported into Rhodesia from overseas have to be submitted to the tuberculin test on arrival; those from the Union of South Africa have, up to the present, been exempt from this test.

This is only the second occasion in the history of Southern Rhodesia that the existence of tuberculosis has been diagnosed in a herd of well-bred cattle, the former being in 1913, when it was discovered in a herd of Devons, from which it was eradicated by the use of the tuberculin test, with a loss of two head. In 1916 a dairy herd in Umtali was found to be infected. Eight animals out of 56 re-acted to tuberculin and were destroyed. With these exceptions, tuberculosis has

not been recorded amongst the herds in this Territory, but odd cases are found amongst animals slaughtered for human consumption. Since 1916 upwards of 88,000 head of cattle from Southern Rhodesia have been slaughtered at the Johannesburg abattoirs, and only 30 cases of tuberculosis detected amongst them.

Quarter-Feil.—A considerable mortality from this disease occurred in practically every district. Reliable statistics are not available, but generally the reports show that fewer adult cattle were affected, and that where the infection has been established for some years the seasonal mortality showed a marked decrease. Of the newer vaccines, Filtrate, Aggressin and Le Clainche and Vallee's have been largely used, and the last named has given most satisfactory results.

Anthrax.—Seven fresh outbreaks, with a mortality of 18 head, occurred as compared with 4 and 105 respectively during the previous year. In every case the animals affected were cattle, and the diagnosis of anthrax at each centre was confirmed microscopically. In the Mtoko district three animals died at different centres where the disease had not previously been known; all cattle in contact, 1,852 head, were vaccinated, and no further losses occurred. In the Hartley district five deaths occurred at two fresh centres, and 363 in-contact cattle were vaccinated. In the Shamva section of the Mazoe district the disease appeared at two fresh and five old centres, the mortality being 10 head. All in-contacts were vaccinated, also a large number of cattle on farms where the disease had manifested itself in 1919; in all, a total of 2,969 head. The vaccine used throughout was the Pasteur double, and the results now recorded are sufficient testimony of its efficacy.

Infectious Abortion of Cattle.—This disease was determined in 36 herds in which its previous existence had not been known to or suspected by the Department. It undoubtedly exists to a serious extent throughout the Territory, possibly unknown to the stock owner in some cases, and to it must, to a large extent, be attributed the low birth rate reported from time to time in ranching and other herds. As no legislative measures, short of total destruction or perpetual quarantine, are likely to prevent the further spread of infection, the only hope of reducing the losses is from some system of vaccination which will hasten the immunity which is slowly and naturally acquired by infected herds. The Government Veterinary Bacteriologist in his report for the year under review deals fully with the subject, and particularly with the results obtained by the use of a "de-vitalised" vaccine. These are most satisfactory, and will no doubt be criticised by those who hold that none but a "live" vaccine can give any degree of immunity. We, at any rate, and also the stock owners in whose herds it has been applied, are satisfied, and content to carry on with it until a better is available.

Senkobo.—This is a native name for a skin disease of cattle which has been described as a contagious impetigo. It appeared in a limited area in the Wankie district some five or six years ago, and since then has been more or less in evidence. It is believed that it was introduced from Northern Rhodesia, where it has been recognised for a good many years. In the form manifested in the Wankie district, the lesions

generally appear on the hairless portions of the body, and gradually extend, particularly to the back. Cases have been observed in sheep and goats in which the lesions are generally found on the head, the lips and ears usually being badly affected. There is some reason to suspect the bont tick (*Amblyomma hebraum*) as the transmitter of Senkobo, but further investigations are required to settle this point. It is significant, however, that in Wankie district the disease has only been observed where this tick is present. To effect a cure, treatment in the early stages is essential; so far, paraffin appears to have given the best results.

Ephemeral Fever (Three-days' Sickness of Cattle).—During the summer months this disease was prevalent in several districts, and, as usual, there was practically no mortality.

Sweating Sickness of Calves.—This extraordinary complaint, of which little or nothing is known, caused a somewhat heavy mortality amongst calves during the rainy season. Treatment is of little avail, and fully 75 per cent. of the animals affected succumb.

Trypanosomiasis.—In the Melsetter and Hartley districts the mortality amongst cattle was considerably less than during the previous year. In the Wankie district a large number of deaths occurred, but reliable statistics are not available.

Myiasis in Cattle.—This condition was not nearly so prevalent as during the previous year.

Horse-Sickness.—The total number of deaths reported during the year from horse-sickness was 124 horses and mules, compared with 89 the previous year. The District Veterinary Surgeon, Victoria, states that it was remarkable that more animals died between May and September than during the so-called horse-sickness season. In Melsetter district the heaviest mortality occurred during the months of June and July.

The Government Veterinary Bacteriologist deals fully with the inoculation of horses and mules against horse-sickness. The results achieved are most satisfactory, and there is every reason to hope that in a few years' time we shall be breeding sufficient horses for local requirements.

Glanders.—No case of glanders occurred, and no re-actions to the mallein test, which was applied to all imported horses, mules and donkeys.

Epizootic Lymphangitis.—The serious outbreak which occurred in Mazoe district in 1919 appears to have been satisfactorily dealt with. No fresh cases occurred amongst the animals involved or elsewhere in the Territory.

Importation and Exportation of Stock.—As all importations and exportations are dealt with by this Department, a schedule is attached showing the numbers dealt with.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

AFRICAN COAST FEVER.—INFECTED AREAS AND MORTALITY, 1920.

District.	Farm.	No. of cattle.	January	February	March	April	May	June	July	August	September	October	November	December	1920	Mortality.
			Total													
Melssetter ...	<i>Existing centres—</i>															
	Tilbury Estate	1,130	37	12	4	31	64	10	10	9					177	178
	Nooitgedacht	61	...	...	...	...	...	...	...	...					...	1
	Morgensen	211	...	...	...	...	...	...	...	...					...	2
	Grasslands	67	...	...	...	...	...	...	...	...					...	1
	Sowerombi	637	...	...	...	...	...	...	...	...					...	1
	N'odzi ...	46	...	...	...	...	...	...	...	...					...	1
	Clearwater and Northfield	658	6	19	8	3	5	1	...	...					42	488
	Avonduur and Leopard's Vlei ...	615	2	19	6	...	...	...	...	...					27	355
	<i>Fresh centres—</i>															
Matobo ...	Glen Divis	...	1	6	1	4	5	1	1	...					1	1
	Rocky Spruit	128	...	8	4	...	...	13	6	...					18	18
	Steamish	244	...	...	...	1	...	...	...	...					32	32
	Matopo Hills	1,064	...	...	...	...	...	...	...	...					...	...
	Forwards	1,425	...	...	...	...	...	...	...	...					...	...
	Sergeants	277	...	...	...	...	...	...	...	...					...	...
	Ravenswood	191	...	...	...	...	...	...	...	...					...	...
	Shashani Farms	2,000	100	26	38	77	66	42	22	7	25	30	10	12	455	455
	Norton ...	44	...	...	...	...	...	...	...	...					...	...
	Famookwe	51	...	...	...	...	...	...	...	...					...	...
Mt. Edgecombe	1,453	...	...	...	...	...	...	...	...					...	...	
Sauerdale	490	...	...	...	...	...	2	...	1	2	...	...	...	5	5	
		146	90	61	116	140	69	39	17	27	30	10	12	757		

Flue-Curing Tobacco Barns and Packing House.

REVISED.

By A. C. JENNINGS, A.M.Inst.C.E., A.M.I.E.E.,
Government Irrigation Engineer.

Plans and specifications for the above were given in Departmental Bulletin No. 334, dated October, 1919, which is now cancelled.

In consequence of the increasing acreage under Virginia tobacco and the possible need for more flue-curing barns, the accompanying drawings of the most approved type of barns and packing house have been prepared under the advice of Mr. H. W. Taylor, Government Tobacco Expert.

Site.—Local conditions will largely determine the most suitable site for the buildings, but, generally speaking, a good level site in close proximity to the homestead and a situation where good foundations can be obtained will be the guiding factors.

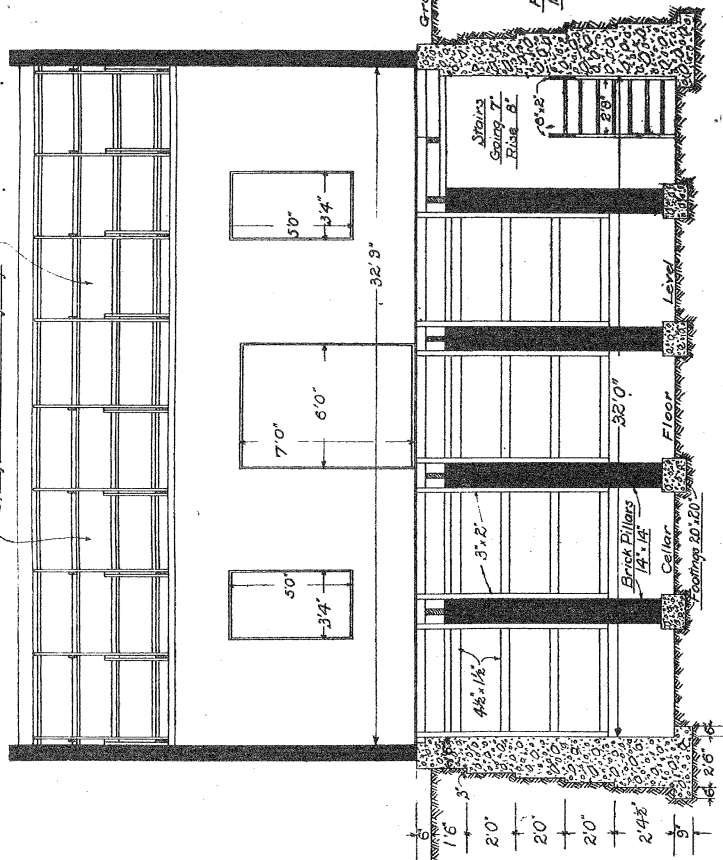
A supply of water should be available at the barns, and arrangements made accordingly.

The position of the barns should be such that the furnaces are on the side away from the prevailing winds, but local circumstances will in many cases determine the best location for same.

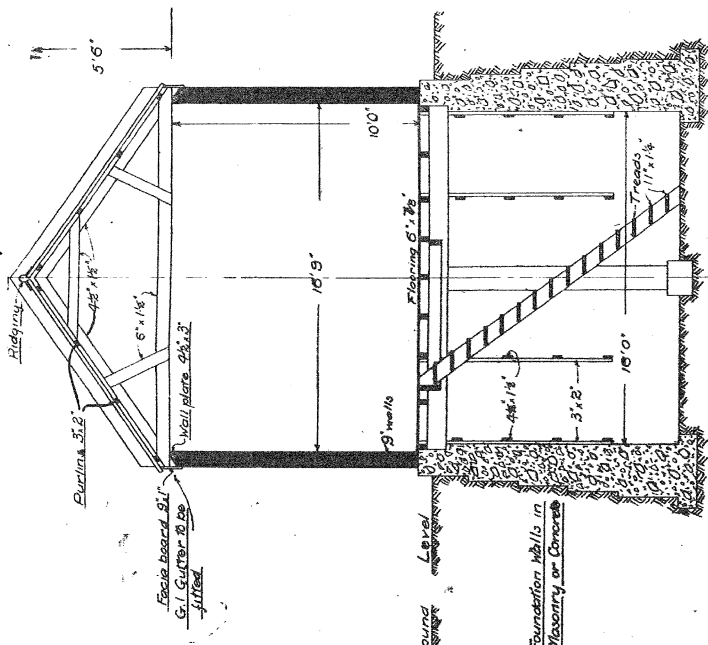
Arrangement of Buildings.—A standard block of four self-contained barns is shown in the drawings, and is entirely separate from the packing house. The latter should be located parallel to the front of the barns at a distance of about 20 feet therefrom, as shown in the key plan on the drawings. This arrangement permits of the barns being easily emptied, and the contents handled expeditiously into the packing house.

The designs and specifications now given, if carried out in detail, will provide buildings of a permanent and substantial nature, and upon which the least outlay in maintenance will be required. The cost will naturally exceed that for less permanent types of buildings, but where a valuable crop like tobacco is being handled every effort should be made to erect buildings which will enable the best results to be attained with the least risk of failure. While good brick work for the walls is generally recommended, other forms of construction, such as *pisé de terre*, have been

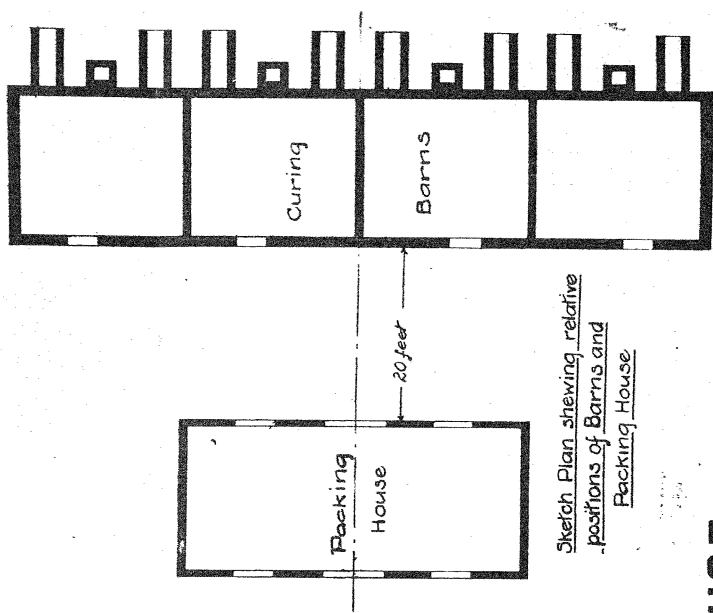
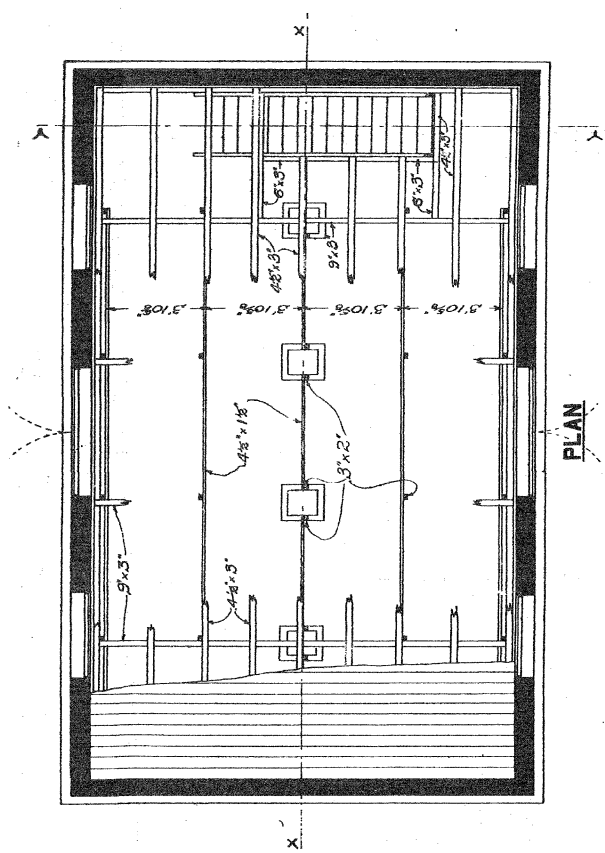
See Elevation 2 on either side of bridge



SECTIONAL ELEVATION ON XX

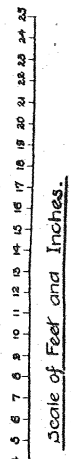


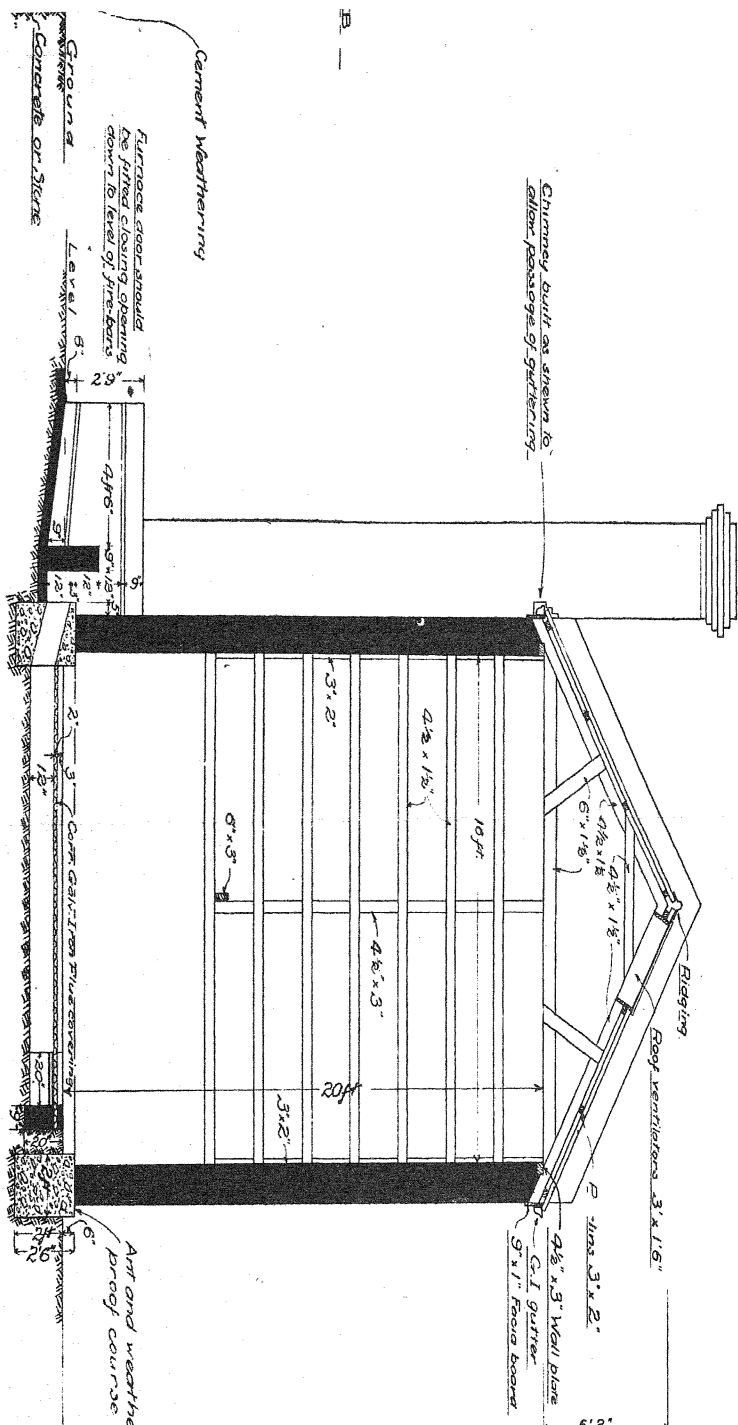
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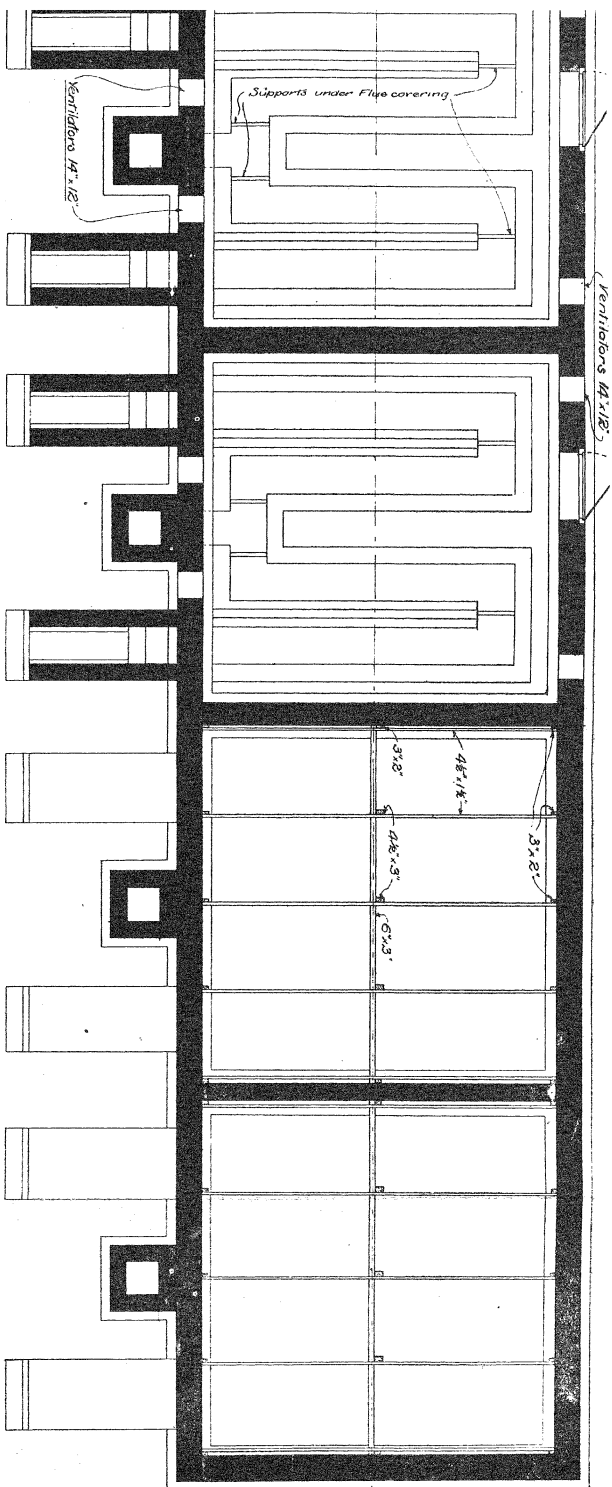


Sketch Plan shewing relative positions of Barns and Packing House

TOBACCO PACKING HOUSE







HALF PLAN ON AA **HALF PLAN ON BB** **BLOCK OF FLUE CURING BARN**

Scale of feet and inches.

found satisfactory, where suitable material is available. Details of a *pisé* tobacco barn were given in the *Rhodesia Agricultural Journal* for October, 1918.

Thatched roofs, if properly constructed, can be used instead of corrugated iron for barns and packing houses, and are less costly. The risk of fire and higher insurance rates are, however, items which should be considered. In cases where thatch is used for the curing barns, the flues should be led at least 12 feet outside the walls and the chimneys built up entirely separate from the building.

Where good native timber or gum poles are available, these can sometimes be used economically for roof members and tiers, in place of the more expensive imported timber, but where these are used care should be taken that they are of sufficient strength for the purpose required.

In the present designs a somewhat new feature has been introduced by adopting brick in place of iron piping for flues, the high cost of the latter making its use almost prohibitive at the present time.

The furnaces have been provided with fire bars, which can be made from second-hand light rails, old plough beams or other suitable material which is often available on the farm. If necessary, exterior doors for regulating the draught can be fitted, but usually a sheet of corrugated iron placed across the opening will meet the purpose.

SPECIFICATION FOR BARNs.

Foundations.—First clear the site of rubbish and level the surface. Dig the foundation trenches 2 feet wide, with the sides square, and to such depth as to obtain a good level and solid bottom. In good firm soil a depth of 2 feet will be usually found sufficient. Where good stone is procurable the foundations should be built in uncoursed rubble masonry, set in cement mortar (1 cement, 4 sand). All stones used should be hard and free from weathering or other defects. They must not be too small nor rounded, and must be laid on their natural bed and well bonded, having no straight joints. Through stones will be placed in every yard of stone work and at all corners. The foundation course will be 2 feet wide throughout, and brought up 6 inches above ground level, and finished off flush.

Where great economy is desired good dagga can be used in building the foundation stone work, but cement is preferable in such work. Cement concrete mixed in the proportions by volume of 1 part cement, 3 sand, 6 broken stone can, if desired, be used for the foundations in place of masonry.

On top of the finished foundations lay a damp and ant-proof course of good cement mortar (1 cement, 2 sand) 1 inch thick, laid truly level; or plain galvanised iron sheeting with a 6-inch lap can be used. Provide a weathering in cement mortar (1 cement, 3 sand) on top of all foundations, as shown on plan.

Walls.—Build all outside walls 14-inch and inside walls 9-inch work, with good hard well-burnt bricks, well bonded, set and bedded in lime mortar (2 to 1) or good clay dagga. All joints to be truly vertical

and horizontal, and every course well flushed up. Outside joints to be raked out to a depth of 2 inches and pointed in cement. No half bricks to be used except where legitimately required for closers, and joints to be struck as the work proceeds.

The division walls in the barns shall be carried up in a similar manner to the gable ends, and there shall be no through timbers.

Door and Window Openings.—Either brick arches or concrete lintels can be built over all openings. If the former are used, the bricks should be rubbed down, and the arches given a skew back of not less than $4\frac{1}{2}$ inches. Concrete lintels should be 9 inches in depth, re-inforced with two lengths of light rails or fencing standards. All door and other frames to be built in and secured with hoop iron.

Roof.—Cover the roof with No. 24 gauge galvanised corrugated iron sheets, 11 feet long each; and place to give a vertical lap of $1\frac{1}{2}$ corrugations. All sheets to be secured to the purlins with galvanised iron screws and washers, and to fit close at ridge. Cover the ridge with 18-inch galvanised iron ridging, securely fixed and beaten down into the corrugation of the roof iron.

Galvanised iron $4\frac{1}{2}$ -inch guttering can be fixed under the eaves to the fascia boards if desired. All joints must be well soldered, and $3\frac{1}{2}$ -inch diameter down spouts fixed at suitable points.

Furnaces and Flues.—In the present design two separate furnaces and flues are provided, the latter being led into a smoke stack at the back of each barn. The smoke stack should be provided with a damper, in order to save fuel and assist in regulating the temperature.

The flues are built in 9-inch brickwork, with clear internal dimensions of 20 inches by 12 inches, and covered with corrugated iron sheets, having their ends built securely into the flue walls. It is preferable to round out the corners of all flues, and they must slope upward at the point where they join the smoke stack.

Ventilators.—Two ventilators shall be provided in the slope of the roof farthest removed from the prevailing winds. These can be built up of $\frac{7}{8}$ -inch flooring boards covered with thin sheet iron, and fitted with cords and pulleys to permit of easily opening and closing same. If desired and in order to give increased ventilation, ridge shutters can be provided, opening outwards and giving a free opening along the whole length of the roof of each barn. Further, four small ventilators each 14 inches by 12 inches and closed by shutters shall be provided in the walls of each barn and fixed about 4 inches above foundation level.

Tiers.—In each barn tier poles will be provided for hanging the tobacco. These will be arranged in the manner shown in the drawings, and care taken that the spacing between tiers is uniform and to the dimensions specified.

SPECIFICATION FOR PACKING HOUSE.

The details specified for the barns shall apply, except where otherwise stated, in the construction of the packing house.

Foundations.—A conditioning cellar is provided to be built below ground level under the packing house. In certain cases where the sub-soil is very hard and compact the foundation walls need be carried about 3 feet only below ground level. In most cases, however, they will require to be constructed in the manner shown in the drawings. These walls may be built either in masonry or cement concrete, according to the materials available. All upper walls to be built in 9-inch work with good hard well-burnt bricks, well bonded, set and bedded in lime mortar (2 to 1) or good clay dagga. Outside joints to be raked out to a depth of 2 inches and pointed in cement.

MATERIAL REQUIRED FOR BLOCK OF FOUR BARNs.

Detail.	Material.	Number or Quantity.	Lengths or Size.
Walls and Furnaces ...	Bricks	66,000	
Flues and Chimneys ...	Do.	15,000	
Roof	Galvanised corrugated iron ...	72 sheets	11 feet
	Wall plates $4\frac{1}{2}$ ins. by 3 ins. ...	8 lengths	16 do.
	Fascia boards 6 ins. by $\frac{7}{8}$ in. flooring	4 do.	12 do.
	Do. do. do.	8 do.	16 do.
	Tie beams 6 ins. by $1\frac{1}{2}$ ins. ...	12 do.	19 do.
	Struts 6 ins. by $1\frac{1}{2}$ ins.	6 do.	12 do.
	Top ties $4\frac{1}{2}$ ins. by $1\frac{1}{2}$ ins. ...	5 do.	16 do.
	Rafters $4\frac{1}{2}$ ins. by $1\frac{1}{2}$ ins.	24 do.	12 do.
	Purlins 3 ins. by 2 ins.	24 do.	16 do.
Roof Ventilators	Framing $4\frac{1}{2}$ ins. by $1\frac{1}{2}$ ins. ...	4 do.	18 do.
	Panels 6 ins. by $\frac{7}{8}$ in. flooring ...	4 do.	18 do.
	Butt hinge	8 pairs	2 $\frac{1}{2}$ inches
Ground Ventilators ...	Frames and shutters 6 ins. by $\frac{7}{8}$ in. flooring	4 do.	18 feet
	Lintels $4\frac{1}{2}$ ins. by 3 ins.	3 do.	16 do.
	Door frames 3 ins. by 3 ins.	3 do.	18 do.
	Battendoors 6 ins. by $\frac{7}{8}$ in. flooring	12 do.	13 do.
	T hinges	14 do.	18 inches
	Barrel bolts	4 do.	6 do.
	Screws and washers	6 gross	2 $\frac{1}{2}$ do.
	Nails	7 lbs.	2 do.
		15 do.	3 do.
		15 do.	4 do.
	Galvanised iron ridding	70 feet	18 do.
	Bolts and nuts for roof timbering	108	5 $\frac{1}{2}$ do.
Tiers	Main support 6 ins. by 3 ins. ...	12 lengths	17 feet
	Uprights $4\frac{1}{2}$ ins. by 3 ins.	12 do.	14 do.
	Cross rails 3 ins. by $1\frac{1}{2}$ ins. ...	120 do.	17 do.
Flues	Corrugated iron	18 do.	15 do.
Foundations	Cement	15 bags	

MATERIAL REQUIRED FOR PACKING HOUSE AND
CONDITIONING CELLAR.

Detail.	Material.	Number or Quantity.	Lengths or Size.
Foundations ...	Masonry or concrete ...	92 cubic yds.	
Walls ...	Bricks ...	12,000	
Roof ...	Galvanised corrugated iron ...	34 sheets	11 feet
	Galvanised iron ridging ...	35 feet	18 inches
	<i>Timber.</i>		
	Wall plates 4½ ins. by 3 ins. ...	4 lengths	18 feet
	Fascia boards 6 ins. by 7 in. ...	4 do.	18 do.
	Do. do. do. ...	4 do.	12 do.
	Tie beams 6 ins. by 1½ ins. ...	9 do.	19 do.
	Struts 6 ins. by 1½ ins. ...	5 do.	12 do.
	Top ties 4½ ins. by 1½ ins. ...	5 do.	12 do.
	Rafters 4½ ins. by 1½ ins. ...	18 do.	11 do.
	Purlins 3 ins. by 2 ins. ...	15 do.	18 do.
Sundries ...	Lintels 4½ ins. by 3 ins. ...	4 do.	16 do.
	Door frames 3 ins. by 3 ins. ...	2 do.	16 do.
	Batten doors 6 ins. by 7 in. ...	14 do.	14 do.
	T hinges ...	6 pairs	18 inches
	Barrel bolts ...	4 do.	6 do.
	Rim locks ...	2	
	Sash fasteners ...	4	
	Screws and washers for galvd. iron	3 gross	2½ do.
	Nails ...	36 lbs.	2 do.
		28 do.	3 do.
		16 do.	4 do.
	Windows 12 light sashes ...	4	10' x 12' lts
	Bolts and nuts for roof timbers	4 doz.	5½ inches
Floor ...	Beams 9 ins. by 3 ins. ...	4 lengths	17 feet
	Joists 4½ ins. by 3 ins. ...	25 do.	14 do.
	Boarding 6 ins. by 7 in. ...	64 do.	17 do.
Tiers in cellar ...	Uprights 3 ins. by 2 ins. ...	14 do.	14 do.
	Cross rails 4½ ins. by 1½ ins. ...	42 do.	16 do.
Stairs ...	Sides 8 ins. by 2 ins. ...	2 do.	14 do.
	Treads 11 ins. by 1½ ins. ...	3 do.	15 do.
Foundations ...	Cement required for lower walls if built in masonry ...	90 bags	
	or concrete 1-3-6 ...	180 do.	
	Cement for pointing outer walls	15 do.	

Southern Rhodesia Second Egg Laying Test.

Ninety-five birds were laying during the four weeks and produced 1,689 eggs, an average per laying bird of 17.779 eggs, or, for the 100 on the test, an average of 16.89 eggs.

There were 1,292 eggs each weighing 2 ozs. or over, and 397 each weighing under 2 ozs.

The total weight of eggs was 218 lbs. 15 ozs. (147 lbs. 11 ozs. of 2-oz. eggs and over and 71 lbs. 4 ozs. of eggs under 2 ozs.).

The maximum number of eggs laid on one day was 73, on 24th August, and the minimum 47, on 3rd September.

The average number of eggs per day was 60.32.

Pen 11 laid 109 eggs during the four weeks.

Pen 9 laid 101 eggs during the four weeks.

Pens 1 and 15 laid 99 eggs during the four weeks.

Pen 16 laid 97 eggs during the four weeks.

Pen 8 laid 95 eggs during the four weeks.

Pen 13 laid 93 eggs during the four weeks.

Pen 4 laid 89 eggs during the four weeks.

Pens 12 and 18 laid 86 eggs during the four weeks.

Pen 5 laid 85 eggs during the four weeks.

Pen 6 laid 84 eggs during the four weeks.

Pen 10 laid 80 eggs during the four weeks.

1 bird laid 25 eggs during the four weeks.

2 birds laid 24 eggs during the four weeks.

7 birds laid 23 eggs during the four weeks.

7 birds laid 22 eggs during the four weeks.

10 birds laid 21 eggs during the four weeks.

9 birds laid 20 eggs during the four weeks.

9 birds laid 19 eggs during the four weeks.

Nine birds were broody during the four weeks; all with the exception of one have been cured; four of these have not yet started to lay. Broodiness is rather rife among the heavy breeds, but some become slightly broody and continue laying.

The weather generally has been favourable for laying, although several cold nights and windy days had a slight detrimental effect on the egg output.

Three birds died during this last period of four weeks, one on the 3rd instant of tuberculosis, another on the 6th of fatty degeneration of the kidneys, another on the 15th September of rupture of the hepatic artery. The first two have been replaced. One bird in Pen 3

is suffering from swelling of the comb and tissues of the head and face, due, presumably, to the bite of an insect (signs of such being noticeable under the eye), and is being treated. The remainder of the birds are in good health.

The winners of the winter test, *i.e.*, for the first 16 weeks, are as follows:—

1st.—Pen 4; C. L. Brown, Salisbury; Rhode Island Reds.
278 2-oz. and over eggs, weighing 37 lbs. 9 9-16ths ozs., and
five under 2 ozs., weighing 9 4-16ths ozs.

2nd.—Pen 7; A. T. Wagstaffe, Pretoria; Black Orpingtons.
271 2-oz. and over eggs, weighing 33 lbs. 7 8-16ths ozs., and
55 under 2 ozs., weighing 6 lbs. 6 9-16ths ozs.

3rd.—Pen 5; H. Tatham, Penhalonga; White Wyandottes.
254 2-oz. and over eggs, weighing 32 lbs. 11 10-16ths ozs.,
and 18 under 2 ozs., weighing 2 lbs. 1 6-16ths ozs. !

It may be noted that one hen in Pen 7, although apparently well and in good condition, has not laid for a considerable period (*viz.*, since 15th April. She has recently died and been replaced), and the work of the pen has been performed by the remaining four hens, which under the circumstances is excellent.

Light Breed Section.

1st.—Pen 2; Mrs. Hunter, Glendale. 344 2-oz. and over eggs,
weighing 47 lbs. 9-16ths oz., and one under 2 ozs., weighing
1 14-16ths ozs.

2nd.—Pen 13; Weymouth Poultry Farm, Bulawayo. 344 2-oz.
and over eggs, weighing 44 lbs. 10-16ths ozs., and 17
under 2 ozs., weighing 1 lb. 15 12-16ths ozs.

3rd.—Pen 11; T. W. Brokensha, Umtali. 342 2-oz. and over
eggs, weighing 43 lbs. 2 4-16ths ozs., and 47 under 2 ozs.,
weighing 5 lbs. 7 7-16ths ozs.

The results are based on the total weight of 2-oz. and over eggs.

ARTHUR LITTLE.

THE SECOND ANNUAL SOUTHERN RHODESIAN EGG-LAYING TEST.
FIVE BIRDS IN EACH PEN.
HEAVY BREED SECTION.
SIXTH PERIOD (24 WEEKS).

1st APRIL, 1921, TO 2ND MARCH, 1922.

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 15th September, inclusive.		
					Total No. of eggs.	Total weight of eggs.	
					2 ozs. and over.	Under 2 ozs.	Under 2 ozs.
1	5	R. Conithard	Salisbury	White Wyandottes	281	181	20 lbs. 15 4-16 ozs.
2	4	Mrs. Brokensha	Umtali	do.	332	14	1 lb. 10 4-16 ozs.
3	7	Mrs. Pocock	Ardennie	Bd. Plymouth Rocks	182	19	2 lbs. 3 5-16 ozs.
4	1	C. L. Brown	Salisbury	Rhode Island Reds	451	14	1 lb. 10 9-15 ozs.
5	2	H. Tatham	Penhalonga	White Wyandottes	379	54	6 lbs. 4 6-16 ozs.
6	6	A. G. Walker	Salisbury	do.	261	44	5 lbs. 8-16 oz.
7	3	A. T. Wagstaff	Pretoria	Black Orpingtons...	374	97	11 lbs. 6 ozs.
Totals					2,260	423	49 lbs. 2 4-16 ozs.

LIGHT BREED SECTION.							
Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 15th September, inclusive.		
					Total No. of eggs.	Total weight of eggs.	
					2 ozs. and over.	Under 2 ozs.	Under 2 ozs.
8	11	E. O. B. Mee	Bulawayo	White Leghorns	338	153	17 lbs. 8 14-16 ozs.
9	5	C. L. Brown	Salisbury	do.	480	23	2 lbs. 8 12-16 ozs.
10	9	Mrs. Redrup	Bulawayo	Black Leghorns	381	50	5 lbs. 14 9-16 ozs.
11	3	T. W. Brokensha...	Umtali	White Leghorns	493	112	14 lbs. 1 9-16 ozs.
12	6	B. S. Edgecumbe...	do.	do.	476	66	7 lbs. 12 ozs.
13	2	Weymouth Py. Fm.	Bulawayo	do.	494	60	7 lbs. 1 oz.
14	10	Yorkshire Py. Farm	do.	Anconas	336	47	5 lbs. 5 13-16 ozs.
15	12	Miss Greig...	do.	White Leghorns	315	60	6 lbs. 15 5-16 ozs.
16	4	E. C. Holmes	Bindura	do.	489	92	10 lbs. 12 9-16 ozs.
17	13	Avondale Py. Farm	Avondale	do.	222	198	22 lbs. 8 4-16 ozs.
18	8	Mrs. Redrup	Bulawayo	Anconas	401	37	4 lbs. 5 8-16 ozs.
19	7	Mrs. Mulligan	Lolatsi	White Leghorns	413	18	2 lbs. 6-16 oz.
20	1	Mrs. Hunter	P.B. Glendale	do.	477	9	1 lb. 1 1-16 ozs.

Departmental Correspondence.

HINTS ON BRICKMAKING.

The Director of Agriculture,
Salisbury.

Sir,—With reference to the article appearing in the *Agricultural Journal* of April, 1921, under "Hints on Brickmaking," I have no doubt the writer knows his subject and means well, but if many others have made and burnt bricks on his instructions, I venture to say that he has been responsible for the loss of a good many thousand bricks in the burning process.

I had my own plant (pugmill, table, mould, etc.) and turned out 50,000 admittedly very good bricks, but seeing the article in your *Journal* re burning, I built the stack and burnt the bricks on the instructions contained in Mr. Dyke's article.

(a) "Each day's work will be ready to stack the next morning." This in my experience is an absolute impossibility without spoiling half the bricks; three days is more like it.

(b) "The stack should be turned at the end of three days, and in six should be ready for burning." This is nothing less than a trap for the unwary, as the real test is the brick being dry right through, which can only be determined by breaking a few bricks open to see; and the time necessary is more like 12 to 16 days in practice.

(c) Dimensions of the kiln. I built a kiln exactly on the lines laid down, the only thing being that instead of two eyes I increased the size to three eyes, that is to say, instead of 20,000 bricks I was burning 30,000. The proportions were exactly in accordance with Mr. Dyke's: at eight feet high the stack had exactly 36,500 bricks, and at ten feet (the height shown) would have contained about 50,000.

(d) "The top being covered with ashes or old corrugated iron well covered with dagga." If this is carried out literally the net result is that the fire in the first place will not burn on account of having no draught. If by dint of constant stoking a sort of a fire is got going, the next thing will be the collection and accumulation of steam in the top of the stack, which will either burst the stack open or, worse still, absolutely ruin the top four or five layers of bricks; the latter happened to me.

Obviously the top of the stack must be left open until the steam is out and the top begins to get hot.

(e) Of several in this vicinity who have burnt their own bricks, I cannot find any who have burnt a stack in three days, and the

general opinion is that it would be very unwise to do so, as quickly burnt bricks are never good. I burnt my own stack for 16 days, and then it was not burnt.

Finally I am only writing you in case my experience may be of use to some other mug who has or will take the article literally. For myself, I have bought my experience at the expense of some 10,000 bricks burst and ruined by being stacked too wet and impregnated with imprisoned steam.

You may make whatever use of the letter you like.

Yours faithfully,

J. R. PIERRE.

P B S Ranching Co., Fort Rixon,
24th July, 1921.

Reply by the Irrigation and Agricultural Engineer.

Your letter of the 24th July, addressed to the Director of Agriculture on the subject of an article as above, which appeared in the April number of the *Rhodesia Agricultural Journal*, has been handed to me for reply.

In connection therewith, I would first state that brickmaking is a work which calls for a very considerable amount of experience and judgment, both as regards the quality of the materials used and the best method of handling them. It is very difficult to lay down any hard and fast rules which will apply in all cases, and I think the writer of the article should have laid greater stress on this point.

Dealing with the various points raised in your letter, I would reply, *seriatim*, as follows:—

(a) The bricks when first made are laid out flat on the drying floor, and are usually ready to stand on their edges the following day. After a further two or three days, when they are about "leather hard," they should be ready to stack into rows about eight courses high and covered with grass.

(b) The time during which they remain in the stacks before burning is purely a matter for observation and judgment, as with some materials under favourable conditions they would be dry in about six days, but with others they would require eight or ten days. This in practice is naturally decided by breaking a few bricks and observing the state of dryness before setting them in the kiln.

(c) The number of hard-burned bricks obtainable from a kiln of the size illustrated in the article would not exceed 20,000, as stated therein. This kiln has a cubic content of 2,087 feet, and with the bricks correctly placed it would be quite impossible to set more than 25,000 unburned bricks. You are therefore incorrect in suggesting that the number given in the article is too low.

(d) The remarks in the latter part of your letter are to a considerable extent correct. The article is certainly incomplete in not stating that a vent should be left at the top of the kiln, but there appears little doubt that the excessive damage by steam experienced by you was to some extent caused by the bricks being set in the kiln when too wet.

(e) It is quite possible under favourable circumstances to burn a kiln of bricks in from three to four days, although in many cases a longer time is taken. The approach to completion of burning will always be indicated by the heat at the top of the kiln, and I think the article is quite clear on this point.

Agricultural Outlook.

The planting season is approaching and farmers are busy preparing their lands and overhauling machinery. The winter wheat crop is beginning to ripen, and reports indicate that there is every prospect of a good harvest. The acreage under wheat is much greater this year and there is an insistent enquiry for land suitable for the growing of winter cereals. The General Manager of the South African Breweries recently visited some of the farms where barley supplied for experimental purposes is being grown. It is understood that as a general rule the crops were not so satisfactory as it was hoped they would be, but the Breweries propose to persevere in their efforts to encourage the growing of malting barley, and have decided to offer the same facilities next season. With more experience in the growing of this crop, better results may be expected.

The position in regard to the price of maize is obscure, as will be seen from the following extract from the latest Trade Report of the National Bank of South Africa Ltd. :—

“Drought reigns throughout Western Europe: Here we have had no rain in the south and east for two to three months, and the rainfall since last autumn is many inches under average.

“There is a good demand for feeding stuffs, but this is tempered by the fact that farmers cannot afford present prices, and large quantities of sheep and cattle are being killed.

“The premium on near grain is going off rapidly owing to the large quantity afloat, and to-day maize afloat is worth not much more than August to September shipment.

“Should rain come, there will be a set-back for the time, though we believe no rain can now give us good grain crops, and is also almost too late to save root crops.

"The question is: Is the undoubted necessity to import larger quantities than usual owing to drought going to prevail against the 16,000,000 quarters, exportable surplus maize, available in Argentine?"

Present conditions bring us against problems which have had to be overcome in other parts of the world, and emphasise the necessity for greater yields per acre and for the more economical marketing of grain by conversion into beef, bacon and dairy products.

Tobacco growers are preparing their seed beds and evidently preparing for a big crop. We would again warn growers against planting a larger acreage than can be efficiently handled, for inferior leaf is likely to be a drug on the market next year. Practically all the seed that is to be sown has been treated for bacterial spot, which seriously injured last season's crop.

This is the most trying time of the year for cattle, as grazing and water supplies are apt to be short. There is more grass than is customary at this time of the year, but it appears to lack nutriment, and many farmers state that their cattle have fallen away more than is usual. Contagious abortion is reported from many fresh districts, but otherwise cattle are generally healthy. Grass fires have been extremely frequent, and passing over inadequate fire guards have devastated large areas.

A good deal of attention is being paid to dairying, and there is keen enquiry for cows from a good milking strain. It is probable that a creamery will be started in Salisbury in the near future, and this should give a fillip to the industry. More attention will, however, have to be paid to the winter feeding of stock, for, as Mr. Downie pointed out at a recent meeting in Salisbury, supplies of cream to the creamery must be regular if working costs are to be kept at a minimum.

A wide range of succulent foodstuffs was grown on the Arlington Experiment Station near Salisbury on moist granite vleiland during the winter months, demonstrating that it is within the power of anyone who possesses such soil to produce the necessary feed.

Southern Rhodesia Veterinary Report.

May, 1921.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—Thirty-five deaths were recorded at Tilbury during the beginning of the month.

QUARTER-EVIL.

Numerous outbreaks have been recorded throughout the Territory, and the following mortality has been reported:—Hartley, 25; Victoria, 76; Melsetter, 41; Umtali, 3; Figtree, 42; Plumtree, 6; Belingwe, 37; Umzingwane, 12; West Nicholson, 15; Inyati, 1; Fort Usher, 8; Fort Rixon, 9; Bulawayo, 10.

CONTAGIOUS ABORTION.

This disease continues to spread in the districts adjoining to Salisbury, and two outbreaks are recorded in Matabeleland.

HORSE-SICKNESS.

The deaths reported are:—Salisbury, 3; Umtali, 1; Ndanga, 1; Plumtree, 5; Gwanda, 2; Fort Rixon, 8; Bulawayo, 4; Enkeldoorn, 5; Gwelo, 5; Umvuma, 2; Melsetter, 3.

SWEATING SICKNESS.

A few cases reported.

TRYPANOSOMIASIS.

Several cases reported from Melsetter and Wankie districts.

IMPORTATIONS.

From the Union of South Africa:—Bulls, 41; cows, 14; donkeys, 124; mares, 101; geldings, 24; mules, 24; sheep and goats, 2,195.

EXPORTATIONS.

To the Union of South Africa:—Slaughter oxen, 339; mules, 2.
To Northern Rhodesia:—Bulls, 9; horses, 3; donkeys, 65; pigs, 50.

To Belgian Congo:—Sheep and goats, 75; mules, 18; pigs, 190. To Portuguese East Africa:—Slaughter cattle, 12; breeding cattle, 18; mules, 5; pigs, 1.

June, 1921.

AFRICAN COAST FEVER.

No cases recorded during the month.

QUARTER-EVIL.

The following mortality has been reported:—Bulawayo, 19; Belingwe, 16; Insiza, 50; Essexvale, 51; West Nicholson, 7; Plumtree, 20; Fort Usher and Figtree, 2; Shabani, 3; Antelope, 4; Inyati, 7; Umtali, 4; Gwelo, 12; Selukwe, 5; Charter, 21; Umvuma, 1.

CONTAGIOUS ABORTION.

Outbreaks have occurred in Umtali, Gwelo, Que Que, Enkeldoorn, Umvuma and Salisbury.

HORSE-SICKNESS.

The following mortality is recorded:—West Nicholson, 1; Bulawayo, 1; Plumtree, 7; Fort Usher, 5; Gwelo, 2; Charter, 4; Melsetter, 2.

TRYPANOSOMIASIS.

Two deaths reported from Wankie District.

FLUKE.

Seven deaths from this affection have been reported from Umtali.

IMPORTATIONS.

From United Kingdom:—Bulls, 2; cows, 5. From Union of South Africa:—Breeding cattle, 84; horses, 260; mules, 72; donkeys, 40; sheep and goats, 2,721.

EXPORTATIONS.

To the Union of South Africa:—Slaughter cattle, 814; oxen, 74; breeding cattle, 1,092; horses, 2; mule, 1; pigs, 50; sheep and goats, 58. To Northern Rhodesia:—Horses, 22; mules, 2; donkeys, 54; pigs, 6; sheep and goats, 70. To Belgian Congo:—Breeding cattle, 250; horses, 15; mules, 8; pigs, 15; sheep and goats, 105. To Portuguese East Africa:—Mules, 3; sheep and goats, 27.

July, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality has been reported:—West Nicholson, 13; Belingwe, 7; Antelope, 21; Shabani, 13; Essexvale, 32; Insiza, 3; Plumtree, 4; Gwanda, 3; Matopos, 50; Umtali, 94; Melsetter, 5; Selukwe, 5; Enkeldoorn, 14; Que Que, 37.

CONTAGIOUS ABORTION.

Fresh outbreaks are being reported from various districts.

HORSE-SICKNESS.

The following mortality has been recorded:—Plumtree, 1; West Nicholson, 1; Umtali, 1; Melsetter, 2; Bindura, 3; Salisbury, 1; Marandellas, 3; Beatrice, 2; Lomagundi, 5; Enkeldoorn, 2.

TUBERCULOSIS.

One re-actor to the test was destroyed at Hartley.

TRYPANOSOMIASIS.

Ten deaths are reported from Wankie district.

SCREW-WORM.

Cases have been occurring in Plumtree and West Nicholson areas.

IMPORTATIONS.

From the United Kingdom:—Bulls, 2; cows, 10. From the Union of South Africa:—Bulls, 55; cows, 50; horses, 258; mules, 50; donkeys, 37; sheep and goats, 12,346.

EXPORTATIONS.

To the Union of South Africa:—Slaughter cattle, 1,814; equine, 1; pigs, 20. To Northern Rhodesia:—Sheep and goats, 70. To Belgian Congo:—Sheep and goats, 30; pigs, 110. To Portuguese East Africa:—Breeding cattle, 210; horses, 8; mules, 2.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Farming Calendar.

October.

BEE KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously, therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolio cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

CITRUS FRUITS.

Irrigation should be continued, followed by thorough cultivation, if no good soaking rains occur. From about the middle of this month to middle of next is the best time to plant orange trees, as they have hardened up their first growth, and if properly attended to will commence to grow right away, so that by the end of the growing season they will have put on considerable growth and established themselves well in the ground.

CROPS.

If ploughing has not been done earlier in the season, it should be undertaken as early as the condition of the ground will permit. A disc harrow or a roller should immediately follow the plough in order to break up the clods. In the case of new lands ploughed for the first time earlier in the season, an attempt should now be made to cross plough these. It is not safe or advisable to plant any summer crops during this month except on vleis soils. Winter wheats will be ready for harvesting, and the stubble should be ploughed in as soon afterwards as possible. Green manure crops should then be put in with a view to ploughing these down in December or early January.

ENTOMOLOGICAL.

Maize.—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially if only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Cutworms are very apt to be troublesome in the wet vleis. See "Cutworms," *Agricultural Journal*, August, 1918.

Tobacco.—Cutworms, stem-borer, leaf miner and other caterpillars are liable to give trouble in the seed beds. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

Potato.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. See "Diseases of the Potato Tuber and Selection of Sound Seed," *Agricultural Journal*, February, 1914. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder) 1 lb. to 30 gallons of water, or (paste) 1 lb. to 16 gallons of water.

Cabbage, Turnip, etc., are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb. Fresh water-slaked lime, 20 lbs. For cabbage aphid wash liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

Beans and Peas are little attacked by insects at this time of year. If aphid (green fly) is troublesome the plants may be sprayed with soap wash or tobacco wash. Leaf eating beetles are best destroyed by hand.

Cucumbers, Marrows, etc., may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started the damage is negligible.

Citrus Trees may be sprayed for scale after the fruit has set. Resin wash is the safest and most efficient spray. Fumigation is still more effective. Avoid using miscible oils for citrus spraying at this time of the year. Destroy out-of-season fruit on account of citrus codling moth. See "Rhodesian Citrus Pests." *Agricultural Journal*, February-April, 1916.

Deciduous Fruit Trees, including grape vines, are liable to attack by chaffer beetles. Heavy spraying with lead arsenate (paste) 1 lb. to 10 gallons of water, or (powder) 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

Fig.—Fruit infested with fig weevil should be collected regularly and destroyed.

FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is more essential than at first thought, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

FORESTRY.

Prick out into tins any trees that are ready. If the ground is soft enough, harrow and cross-plough the land broken up in the early autumn.

POULTRY.

A bird if she is going to lay at all should be doing so now; any that are not should be killed for eating. The birds should be gone over individually, and the poor layers culled out. The method of distinguishing between the good and bad layers was clearly defined in the *Agricultural Journal* for December, 1919. There are too many bad layers and unprofitable birds on farms and in poultry yards, and the owners are losing money on them. See that shade is provided for adult birds and young stock, especially the latter, and that their sleeping quarters are not hot and stuffy. The adult birds should have Epsom salts and Glauber's salts alternately every three or four days during the hot weather; for the young stock once a week is sufficient; the quantity is two good teaspoonfuls to every quart of drinking water. Once a week a little permanganate of potash in the drinking water keeps hot weather intestinal troubles in check. Keep a constant watch for insects during the hot weather, and dip the birds and spray the houses to keep these in abeyance. A good dipping solution is as follows:—One tablespoonful of Kerol, Hycol, Jeyes' Fluid or similar disinfectant to a paraffin tin of warm water. For a spraying solution:—Two tablespoonfuls of one of the above to a paraffin tin of hot water. This is the season of the year when the fowl tick seems to be most active and

virulent. A strict watch for these insects should be kept and their extermination, if present, immediately seen to. Bulletin 377 and the issue of this *Journal* for October, 1920, deal with this fully. Ample green food should be supplied to the birds at all times; without it we cannot expect good health in the birds, nor eggs.

STOCK.

Cattle.—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded, if this has not already been done, and care should be taken that they do not suffer any serious set-back by reason of the want of veld. If calves are not desired in mid-winter, the bulls should be taken out of the herd now until the end of January. Care should be taken to provide a plentiful supply of clean water, and dipping must be regularly attended to.

Sheep.—If spring lambs are expected, one should see that the sheep shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the case of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient.

VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and mealies may also be sown this month.

VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

WEATHER.

This is apt to be a hot dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld fires at this time of year adds to the anxiety of the stock owner. The average rainfall in Mashonaland is from one to one-and-three-quarters of an inch; in Matabeleland one inch or so, and rather less in the Zambesi Valley. Generally speaking, the rain is more plentiful and earlier in the eastern districts, and takes the form of thunder showers at this time of year.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

November.

BEE KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must still be resorted to, in order to keep the trees in good growth and not allow any check to the fruit. This is the best month to sow beans or other seeds for ploughing in later as green manure. Sow about 75 lbs. of kaffir beans per acre, so as to cover the whole area with a green covering.

CROPS.

This month is one of the busiest on the farm. Planters, cultivators, etc., should be examined and put into order. A great many of the misses in the maize field are undoubtedly due to faulty planting. All seeds should be overhauled, and ground nuts intended for seed are best shelled immediately before planting. Planting and sowing will commence with the rains. Among the first crops to be sown are maize, velvet beans (for seed), ground nuts, dhal and sunflower. Napier fodder roots may be divided if the rains will allow of transplanting.

ENTOMOLOGICAL.

Maize.—Crops planted before the last week in this month are very liable to suffer later from stalk borer. Wherever practicable postpone planting until December. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Red lands may be baited at the end of the month against surface beetles, snout beetles and other pests which reduce the primary stand of plants. See "Maize Culture on Red Soils," "Value of Poisoned Bait as an Aid to Good Stands," *Agricultural Journal*, April, 1919. Cutworms are not likely to attack the crop badly on red soil until December, but may be in evidence in vleis situations in November. See "Cutworms," *Agricultural Journal*, August, 1918. The black maize beetle will be in evidence on infested farms, but this pest has as yet been imperfectly studied. See "The Maize Beetle," *Agricultural Journal*, February, 1918.

Tobacco.—Practically all the enemies of this crop are apt to be injurious when it is newly planted out. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

Potato.—The first brood of the leaf-eating ladybirds commences in November. See "Two Ladybirds injurious to Potato," *Agricultural Journal*, October, 1913. Blue blister beetles are frequently a nuisance on sandy soils, and caterpillars may be troublesome. The potato tuber moth is apt to cause injury to the tops at this time of year. An arsenical spray, such as arsenate of lead or Paris green, can be used to check these pests.

Cabbage, Turnip, etc.—Diamond-back moth and webworm are the chief pests, though cabbage aphids may be in evidence (see under October). Liberal watering and washing the plants down regularly with a forceful stream of water from a hose or spray pump helps considerably against the cabbage aphids.

Beans and Peas.—As under October.

Cucumbers, Marrows, etc.—As under October.

Citrus Trees.—As under October.

Deciduous Fruit Trees.—Chafer beetles may still be injurious (see under October). Choice varieties of early peaches may be netted as a protection against fruit-piercing moths.

Fig.—As under October.

FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this country :—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Eschscholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

FORESTRY.

Any young plants that are still in the beds should be pricked out into tins in the early part of this month. It is really rather late for this work. If the cross-ploughing and harrowing were not tackled last month, it should be done now.

POULTRY.

Watch for birds commencing to moult this month : if any start doing so, they should if possible be fed on foods as detailed in the Calendar for November, 1919 (*vide Journal* for October, 1919). Diseases caused by bacteria and bacilli are more prevalent during the months of October, November and December, and for these see *Agricultural Journals* for June and October, 1919. There should be no male birds running with the hens at any time except during the breeding season (viz., from March to the end of August), and especially should this be avoided during the hot season, for it is the cause of many bad eggs. We want no bad eggs in Rhodesia, but a reputation for good ones, especially when we commence to export, which should come shortly. Prepare for the rainy season; see that there are no hollows near the houses to cause pools; that the floors of the houses are well above the level of the surrounding ground; that the roofs are water-tight, and that the birds will always be dry during the heaviest rain. It is only by attending to this that eggs will be produced in quantity; therefore see to it now, and do not wait till the rains commence, for once the fowls get wet, the mischief is done. Remember that it is much easier for a fowl to stop laying than to bring her on to lay again. Never forget the grit, charcoal and clean water; without them the birds produce few eggs and are sure to become ill and will probably die. To ensure the supply of eggs, animal protein in some form, whether thick separated milk, raw meat, meal or fish meal or insects, *must* be supplied to the birds. Grains, meal and green food alone are not sufficient.

STOCK.

Cattle.—Normally rains will have fallen and the veld will be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or mealies daily. Dairywomen will not require to feed much succulent food, and usually the more expensive protein foods may be considerably curtailed at this time, but good sweet hay and mealies will be found to be very beneficial to milch cows, even if the veld is very plentiful. Clean dry sleeping places for both cows and calves will pay handsomely for any extra trouble involved. Young calves do not need to walk far, and in wet weather are much best in a clean dry pen. Watch for ticks.

Sheep.—Keep the sheep on high dry land. Be careful to keep the ticks down. Be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out.

Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks, and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity.

VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunder storms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy down pours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows.

In an ordinary season the rainfall is from four to five inches, more in the east and less in the west and in our two great river valleys of the Zambesi and Limpopo. Before the rains commence, severe heat, trying on account of the strong winds and the dryness of the air, is likely to be experienced.

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st September until 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all collection and forwarding, and railway charges. Sufficient seed of each kind to sow one-quarter to one-half an acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture, Salisbury.

Summer Oats.—Sixty-day or Kherson, Burt.

Rice.—Dryland or hill rice (for wet vlei soils).

Oil Seeds.—Linseed, sunflower, Spanish ground nuts.

Legumes.—White stingless velvet beans, dolichos beans, sunn hemp (for green manuring), dhal, beggar weed (a valuable dryland substitute for lucerne), lupins (a green manure crop for sandy soil), Black-eyed Susan field pea, kudzu vine, sweet clover.

Hay Crops.—Teff grass, manna, red manna.

Pasture Grasses.—Kikuyu grass, African star grass, Rhodesian tussock grass (a few roots of each sufficient to start a small nursery).

Miscellaneous Crops.—Buckwheat, Niger oil (for green manuring), sweet potato vine cuttings.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

Farmers who are interested in the native grasses, legumes, weeds, etc., which occur on their farms are invited to send specimens to the Department for determination and naming.

In all cases where a botanical identification is required, it is of the utmost importance that the specimens reach the Department in a thoroughly dry condition, free from mildew, and intact, that is, not broken in pieces. Whenever possible, specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three to seven days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) colour and appearance of flowers;
- (c) class of soil on which found;
- (d) locality and altitude;
- (e) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

All specimens and correspondence on this subject should be addressed to the Chief Agriculturist and Botanist.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are on rail Salisbury, plus a small charge for collection and forwarding fees Salisbury, or f.o.r. the Gwebi experiment farm.

On account of the limited supply available in some cases, it is impossible to guarantee the full delivery of any order. Farmers are

therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seeds are consigned carriage forward in the case of stations. In the case of sidings, the amount of railage will be notified after despatch.

Hickory King maize, 20s. per 100 lbs., selected hand-picked seed.
 Salisbury White maize, 20s. per 100 lbs., selected hand-picked seed.
 Ground nuts (Spanish), unshelled, 20s. per bag.
 White stingless velvet beans, 20s. per 100 lbs.
 Black-eyed Susan pea, 25s. per 100 lbs.
 Sunflower seed, 15s. per 100 lbs.
 Teff grass, 9d. per lb.
 Manna, 4d. per lb.
 Sunn hemp, 3d. per lb.
 Niger oil, 3d. per lb.
 Linseed, white flowering, 6d. per lb.
 Majorda melon seed, 1s. 6d. per lb.
 Buckwheat, 2d. per lb.
 Sweet potato slips, 5s. per 100 slips.

SERVICES OF GOVERNMENT VETERINARY SURGEONS.

1. The services of Government Veterinary Surgeons are available to the public, free of charge, for the following purposes only:—

- (1) Attending and giving professional advice in connection with the following diseases, viz.:—Anthrax, Contagious Abortion, East Coast Fever, Epizootic Lymphangitis, Foot and Mouth Disease, Farcy, Foot-rot, Heartwater, Glanders, Intestinal Parasites amongst sheep and goats, Liver Disease, Lung-sickness, Osteo Porosis, Malarial Catarrhal Fever (blue tongue), Rabies, Rinderpest, Scabies, Sponziekte (quartér-evil), Swine Fever, and any other diseases which may in future be scheduled in terms of section 3, sub-section 18, of the "Animals Diseases Consolidation Ordinance, 1904." Attending to cases of disease amongst live stock which, though not of a contagious or infectious character, may be of general public importance.
- (2) Applying tests in regard to Glanders, Tuberculosis, or any other disease against the introduction or spread of which tests are applied under regulations.

2. The following charges shall be made and payable for services rendered by the Government Veterinary Surgeons in other cases, viz.:—

	£	s.	d.
(1) For every professional visit within three miles of his office or residence	0	5	0
(2) For every professional visit beyond such distance	0	10	6
plus an additional charge of 2/6 per hour whilst engaged in such visits, or £2 2s. a day of 24 hours;			

(3) For advice given at the Veterinary Surgeon's office £ s. d.
0 2 6

(4) The following to be charged in addition to visiting fees:—

a. For every examination as to soundness ...	1	1	0
b. For castration, horses, each	1	1	0
c. For castration, bulls, each	0	5	0
d. For castration, donkeys, each	0	10	6
e. For parturition cases, mares, each	2	2	0
f. For parturition cases, cows, each	1	1	0
g. For other operations, according to nature, from 5s. to £2 2s.			

3. Double the above fees will be payable for services rendered on Sundays, public holidays, and between the hours of 7 p.m. and 7 a.m.

4. Applicants for the services of Government Veterinary Surgeons must at their own cost provide the necessary transport for the conveyance of these officers from and back to their stations. If the Government Veterinary Surgeon is required to travel by rail, the cost of the railway ticket will be charged to the applicants, and if any other necessary transport is not supplied by the applicant, then the cost of supplying or hiring such transport as may in the opinion of the Government Veterinary Surgeon be necessary and suitable shall also be so charged.

5. Farmers and owners of stock throughout the country frequently telegraph for a Government Veterinary Surgeon to be sent to attend an animal which has been taken seriously ill. It is rarely possible to comply with these requests at once, as the Veterinary Surgeon may be engaged on duty which he cannot leave, or is at such a distance from where his services are required that he can hardly be expected to arrive in time to be of any service in an urgent case. Hence much valuable time is wasted, the owner of the animal is dissatisfied, and the veterinary staff discredited. To obviate this, in all cases where veterinary advice and assistance are required, the owner should telegraph to "Veteran," Salisbury, with prepaid reply, the nature of the complaint that the animal is suffering from, giving as full and accurate a description of the symptoms as possible. This will enable the Chief Veterinary Surgeon to telegraph advice at once and state whether he is able to arrange for veterinary attendance on the case or not, and save valuable time, which is always of importance in acute cases.

6. The services of Government Veterinary Surgeons will only be available for private work with the consent of such officers, and when such work does not interfere with their official duties, or when the services of a private practitioner are not available.

7. As the arrangement of allowing Government Veterinary Surgeons to attend to private cases is intended purely for the benefit of farmers and stock owners who may wish to obtain professional advice, no responsibility whatever will be accepted for any loss of stock, etc., which may result from the negligent treatment or advice, or wilful default, of any Government Veterinary Surgeon.

8. All fees to be payable direct to the Government Veterinary Surgeon concerned.

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
 No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.

TOBACCO.

- No. 132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley
 No. 144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
 No. 333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
 No. 339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
 No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
 No. 347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
 No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
 No. 398. Wildfire and Angular Spot.
 Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
 No. 224. Statistical Returns of Crops, 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
 No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
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Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No 396 of 1921.]

[12th August, 1921

PRODUCE EXPORT ORDINANCE, 1921.

IT is hereby notified that His Honour the Administrator has been pleased, in terms of section 4, sub-section (c), of the "Produce Export Ordinance, 1921," to exempt from the provisions of the said Ordinance maize from Northern Rhodesia in transit through this Territory.

No 397 of 1921.]

[12th August, 1921.

GAME LAW CONSOLIDATION ORDINANCE, 1906.

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of the "Game Law Consolidation Ordinance, 1906," to declare that all game within the limits of the commonage of Que Que shall be strictly protected and shall not be hunted or destroyed for a period of five years from the date of this notice.

No 436 of 1921.]

[2nd September, 1921.

CATTLE CLEANSING ORDINANCE, 1918.

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of the "Cattle Cleansing Ordinance, 1918," to approve of the following regulations for the better carrying out of the objects and purposes of the said Ordinance:—

1. Whenever the Administrator requires the owner of land to provide facilities for the cleaning of cattle of natives residing on such land in terms of section 10 of the above-mentioned Ordinance, or requires an owner or person to construct a dipping tank in terms of section 12 thereof, a notice of such requirements under the hand of the Secretary to the Department of the Administrator, served personally or contained in a registered letter addressed and posted to such owner or person, shall be deemed to be sufficient notice.

2. A notice issued in terms of the last preceding regulation shall contain particulars of the requirements referred to therein and shall fix a reasonable date within which they must be complied with. Any person failing to comply with such requirements within the time specified shall be liable on conviction to the penalties provided in section 16 of the above-mentioned Ordinance.

RHODESIA **Agricultural Journal.**

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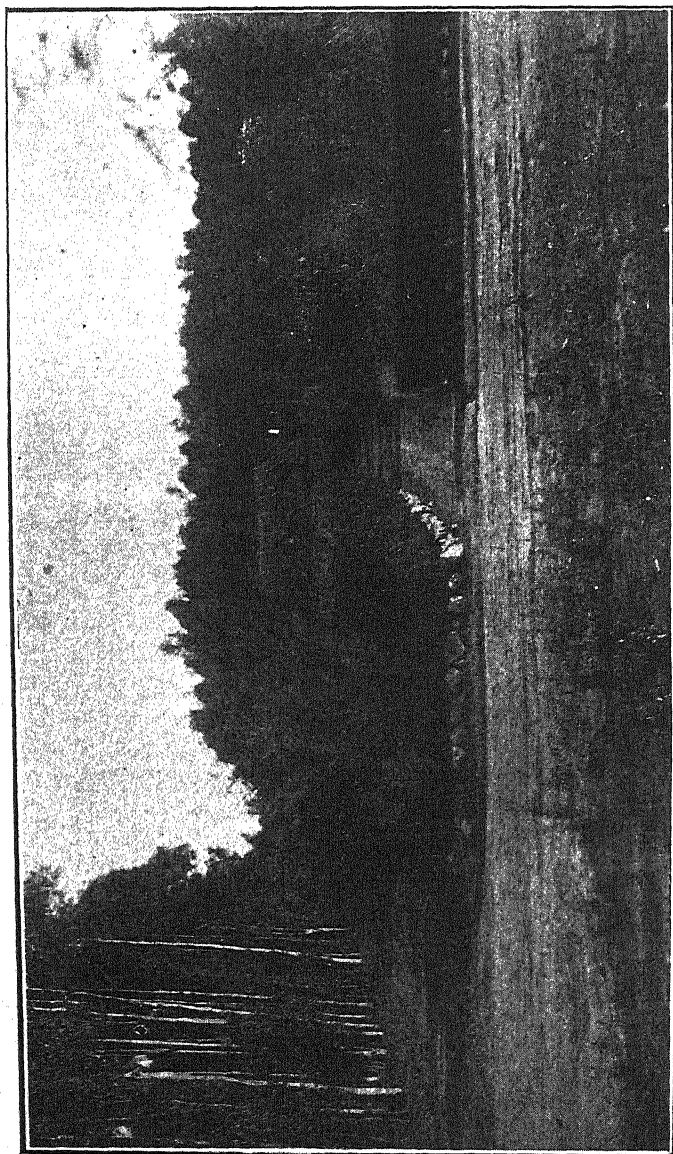
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An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for, at the rate of 1/- for every 10 words.



Government forest nursery near Salisbury.



THE RHODESIA
Agricultural Journal.

Issued by the Department of Agriculture.

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VOL. XVIII.]

DECEMBER, 1921.

[No. 6.]

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Water Power Resources of Southern Rhodesia.—The article in this issue bearing the above title was prepared by the Hydrographic Engineer for the information of the Imperial Power Conference, which has been constituted to investigate the water power resources of the Empire. Owing to the high costs of production, the question of cheaper sources of power is receiving very much attention at the present time. Our knowledge of the water power available in this country is very elementary and will require much detailed investigation. The present report is an attempt, from the data available, to define the areas in the Territory in which large power schemes are possible, and a rough first approximation is made as to the relative value of these probable schemes. From this it appears that, exclusive of the Victoria Falls,

there is continuously available a supply of 100,000 to 150,000 h.p. distributed at various points about the country. This is an asset of great value which has been very little utilised at present, but will undoubtedly ultimately be a source of national wealth.

The report, which will be concluded in the next issue of the *Journal*, is of general interest, and will be reprinted later in bulletin form.

Infectious Abortion of Cattle and Malta Fever.—We publish in this issue a paper read by Mr. L. E. W. Bevan, Government Veterinary Bacteriologist, at a meeting of the Southern Rhodesia Veterinary Association and attended by a number of medical practitioners. The paper deals with the possible relationship of infectious abortion in cattle to Malta fever in man, and the subject is one of the greatest importance to the community. It is common knowledge that a number of cases of Malta fever have occurred recently in the Territory, and a strange feature of the sickness is that many of the persons affected have not imbibed goat's milk, the usual source of infection. What then is the cause? Mr. Bevan in the course of his investigations has found that a close affinity exists between the serum of cattle infected with contagious abortion and the organism which causes Malta fever in man; and, conversely, that the serum of human beings infected with so-called Malta fever causes a similar re-action with the bacillus of abortion. These observations have been confirmed by Dr. Orpen, the Government Medical Bacteriologist, who has been working independently on the subject. The close morphological and biological relationship existing between the two organisms has been known to science since 1916, but while circumstantial evidence points to the infection of man by *B. abortus*, the final proof is not yet available.

Mr. Bevan produces evidence which places the aborting cow under strong suspicion, and it was for this reason that members of the medical profession were invited to attend the meeting. The discussion which resulted was of a most instructive nature, and justified Mr. Bevan's contention that the most profitable and scientific manner to study disease was from the comparative standpoint.

We consider that Mr. Bevan has rendered a valuable service to the community by focussing attention on a matter of serious import, and we trust that the data he has collected will form the basis for further and systematic investigation by the medical authorities.

The measures adopted by the Veterinary Department to combat infectious abortion in cattle are outlined in Mr. Bevan's paper, and we understand are proving effective. A limited quantity of the vaccine prepared by Mr. Bevan will shortly be available and will be issued through the District Veterinary Surgeons, to whom application should be made. A charge of 1s. per dose will be made, and three doses are considered necessary for the complete treatment. The vaccine will be supplied in order of application, and only on receipt of payment for the full treatment.

The Export of Maize.—As a temporary measure to assist the export of maize the railway administration has agreed to a reduction of the Beira flat rate from 21s. 11d. per ton to 17s. 6d. per ton. The reduced rate applies during the period 1st October, 1921, to 31st March, 1922, and it is announced that a further reduction of 2s. 6d. will be granted when the c.i.f. selling price of maize oversea does not exceed 35s. per quarter. The latest cabled prices appearing in the local press are below this figure, and the present rate may therefore be reckoned at 15s. per ton. The local rates for maize and kaffir grain have been increased by 25 per cent., to apply during the six months 21st October, 1921, to 19th April, 1922, and maize meal will be subjected to an additional charge of 20 per cent. on these revised rates.

A subsequent notice announces that for next season's crop the export rate for maize will be 17s. 6d. per ton, provided the oversea selling price (c.i.f.) of maize does not exceed 37s. 6d. per quarter.

The sea freight on maize from Beira has now been reduced by 10s. per long ton, the reduction to hold good until the end of January next. The combined saving in railage and freight amounts to nearly 1s. 8d. per bag, a concession which we are sure will be appreciated by most maize growers, although there are some who regard the alleviation as inadequate, and are not inclined to be thankful for small mercies.

The General Manager of the Farmers' Co-op., Ltd., recently advised maize growers not to be influenced by the present slump in the price of maize to lessen the area under this crop, and this we feel cannot but be sound advice. Although the advantage of having more than one crop is evident by now, our maize growers must not forget that maize is a crop they have specialised in and brought to a pitch of laudable perfection. They have every reason to hope for better times, as the quality of their product is second to none in the world. Failure to supply at the present juncture would probably only tend to depress the possibilities of this trade in the future by impairing the confidence which home buyers have in our grain.

Yellow v. White Maize.—The following resolution was adopted at the last meeting of the Maize Association, held in Salisbury, 27th October:—"This Association, being convinced that the introduction of yellow breeds of maize into the Territory will be a vital danger to the maize growing industry, urges all growers to abstain from planting yellow varieties."

The discussion was initiated by Mr. C. C. Townsend, who urged the Government to carry out field trials with yellow maize. In doing so he drew attention to the higher price which the latter type often secures on the English market, where, he had been informed, maize was considered solely on its merits as a stock feed. He ascribed the preference to the fact that owing to the relative size of the berries a given weight of La Plata maize would contain two germs to one of large flat white. Replying to a question as to the oil content of La Plata maize, Mr. Storie, of Messrs. Mark Harris Manufacturing Co.,

Ltd., gave the figure as $5\frac{1}{2}$ per cent. against $4\frac{1}{2}$ per cent. for white maize, but he had, he said, found little if any difference in the oil content of ordinary yellow maize as compared with "whites."

Replying to the discussion, Mr. Mundy, Chief Agriculturist, said that one of the first things he had done when he came to Rhodesia in 1909 was to communicate with the London Corn Trade Association and with manufacturers in Great Britain with a view to ascertaining the variety of maize for which there would be the greatest and best demand. The correspondence was published in the *Rhodesia Agricultural Journal* during the years 1909-10-11, and the consensus of trade opinion was that Rhodesia would reap a great advantage by specialising in the large white flat type. Farmers were therefore advised to concentrate on this type. Even as late as 1918, Mr. Walters was assured by the London Corn Exchange that there was a premium on Rhodesian white flat maize, though the exact figure was doubtful. Mr. Mundy did not support the theory that yellow maize would give a greater yield per acre throughout the Rhodesian maize belt, and the fact had also to be taken into consideration that if they experimented with yellow maize they would at once cease to keep their white breeds pure. Certain standard yellow varieties were tried at the Gwebi experiment farm for three seasons, but these showed no greater yield and a lesser resistance to rust.

Proceeding, Mr. Mundy said the London Corn Trade Association had been written to and asked whether in their opinion the farmers of Rhodesia had made a mistake in growing white varieties, and how it was, in spite of the assurances of the past, that there was apparently no preference for white maize on the London markets, where on the contrary it was quoted lower than La Plata, and sometimes lower even than American. When a reply was received it would be placed before the Association.

The matter is of the greatest importance to maize growers of this country, and information on the points raised will be awaited with the keenest interest. In the meanwhile we feel sure that growers will abstain from planting yellow maize, the introduction of which would undoubtedly cause wholesale injury to our white maize, which by years of careful selection and breeding has been brought to such a high standard.

The following resolution, having a direct bearing on this matter, was subsequently passed unanimously: "This Association requests the Agricultural Department to introduce legislation prohibiting the planting of yellow maize in the principal maize belts." The resolution was confined to the maize belts because it was considered that in the drier portions of the Territory farmers might wish to grow a quick maturing yellow variety for stock feed. At present, however, there is no evidence that in such parts of the Territory "yellows" give any better yield than "whites."

Cost of Production of Maize.—This was an item on the agenda of the annual general meeting of the Maize Association. A form giving the various headings under which charges should be allocated

was submitted by the President and was discussed. Several of the items did not find favour with those present, although the opinion of the meeting was decidedly in favour of obtaining these figures, and it was finally decided to refer the form back to the Executive for further consideration and submission to a subsequent meeting. A suggestion by Mr. F. C. Peek that figures should be obtained over a period of at least three years was supported, and will, we hope, be acted upon. The figures supplied will, no doubt, vary considerably, as conditions in different parts of the country are so dissimilar. The data will, however, be a valuable basis for estimating the cost of production under normal conditions, and for this reason we are pleased that the Maize Association are taking the necessary steps to procure the figures. It was interesting to hear from the chairman that his production cost last season was 5s. 6d. a bag, and that his farm was ten miles from the railway. On the other hand, his acre yield was exceptionally high, and his farm is usually considered one of the best arable farms in Rhodesia. If, therefore, his costs were 5s. 6d. a bag, the relative cost on less favourably situated farms, where the acre yields are smaller, will obviously be very much greater.

Seed Maize.—"This Association urges all breeders and growers of seed maize to clearly mark each bag of seed maize sold with the name of the grower, and also to state on an enclosed label the name of the variety and the method of tipping, butting and shelling. This Association is also of opinion that all members, when advertising seed maize, should state clearly whether the seed is hand or machine shelled."

This resolution was passed at the annual general meeting of the Maize Association. In speaking to the resolution, the chairman (Mr. A. R. Morkel) explained that seed maize shelled by machinery was often offered for sale, and that such seed was not recommended for planting, as the cracks made in the grain by the sheller impaired germination.

It is very desirable that, after selecting maize ears for seed, the processes of tipping, butting and shelling should be performed by hand, and we are pleased that the Association have taken action in the matter. If put into practice, purchasers of seed maize will in future always know by whom the seed was grown and the degree of care taken in its preparation. They will thus be in a better position to judge of its market value.

Maize Matters.--Amongst other important business transacted at the last meeting of the Maize Association it was decided to appoint standing committees (1) to enquire into the various methods of reaping and report as to which was most economical; (2) to carry on propaganda work and to ascertain the most favourable markets for Rhodesian maize; and (3) to instruct the public regarding the uses to which maize may be put as a food, and to investigate other possible uses which might be made of it, such as the manufacture of starch, alcohol, etc.

On the subject of propaganda Mr. Mundy explained in reply to a question that the Department this year had sent samples to all the principal corn exchanges, and that samples were sent periodically to the London Corn Trade Association at intervals of about six weeks.

It is of interest to note from the South African Journal of Industries that samples of South African maize starch were recently submitted to English authorities. The Calico Printers' Association, Ltd., of Manchester, wrote: "We find them to be of good quality, quite equal to similar materials bought by us from America. We anticipate that we should be able to make use of substantial quantities if your prices are right, supplies regularly available and the quality fully maintained." The Bradford Dyers' Association, Ltd., wrote: "We find both colour, moisture and acidity, etc., similar to U.S.A. corn products as per copy of analysis herewith, and therefore would meet our requirements in the same way as the U.S.A. products." The S.A. Journal of Industries goes on to state that a commercial shipment of starch recently left South Africa for England, and it is understood that regular quantities can be supplied in the future, provided satisfactory prices are obtained.

The World's Poultry Congress.—On the 5th September last, at The Hague, Holland, the first session of the World's Poultry Congress was opened by Dr. Lovink in the presence of H.M. Queen Wilhelmina, the Prince Consort, the officials of the Royal Household, heads of Naval, Military and Civil Departments and over 1,000 delegates, experts, scientists and specialists of poultry husbandry from nearly all the countries of the world. From the British Isles alone between 150 and 160 representatives attended. The Congress was the conception of an Englishman, Mr. Edward Brown, President of The International Association of Poultry Instructors and Investigators, of which the Rhodesian Poultry Expert is a member. The four primary objects of the Conference were defined by Mr. Brown as follows:—

1. To increase the world's food resources.
2. To provide nutrition in the best form and sufficient in quantity for men and women under modern conditions.
3. To enhance and improve the prosperity of peoples of every land in every sphere of endeavour by affording fuller opportunities for labour, enterprise and food production, and to help to restore a war-stricken world.
4. To increase the interests and enrichments of life by stimulation of constructive life and by enlarging the various ideals.

Papers dealing with every phase of poultry keeping were read, and some of the subjects discussed were: "Mendelism and Heredity"; "Genetics of Egg Production"; "Poultry in the World's Feeding"; "State and Other Official Action, including Reconstruction"; "International and Home Trade in Eggs"; "Co-operation and Organisation of Poultry Societies"; "State Control of Infectious Diseases"; "Vac-

cines and Serums"; "Veterinary Aid in Poultry Diseases", "Eggs by Weight"; "Egg Marking."

The reading of the papers and the discussions which followed occupied four days. In regard to the marking of eggs it was decided that the country of origin, the name of the exporter and the date should be shown. The advantage of this marking is obvious.

An exhibition of poultry, foodstuffs, houses, appliances, etc., was held in conjunction with the Conference, and was attended by the same large assemblage present at the Conference. The poultry on view came from all parts of the world, and were specially selected for exhibition. The social side of the Conference was not neglected, and the hospitality extended to the visitors was of a most lavish description.

The Conference was an unqualified success and an indication of the progress which the poultry industry is making throughout the civilised globe.

Our Exports.—The Trade Returns for the eight months of 1921 ended 31st August show that maize and maize meal to the value of £132,449 were exported from Southern Rhodesia. Our exports of tobacco amounted to 1,341,259 lbs., valued at £104,052, against 1,005,830 lbs., valued at £81,515, for the corresponding period of last year. There has been a very considerable decrease in the exports of slaughter stock as represented by the total 5,805 against 19,424 last year. The decrease in value amounts to more than £1 per head. In August this year only 180 beasts were exported. The number of hides and skins exported during the period under review amounted to only 176,171, valued at £4,682, compared with 1,297,610, valued at £105,404, for the eight months of 1920. The difference in hide values as between 1921 and 1920 is very marked, and is doubtless due to the stagnation of the markets in Europe. There has been for the greater part of the present year an entire absence of demand for skins, and consequently there have been few exported. A marked change came over the markets in July, and prices steadily improved until the end of October, when there was a general all round appreciation of 50 per cent. over June prices. A re-action, however, appears to have set in, and although the fall in prices is not yet very marked, the prospects are not considered good. Butter reveals a more satisfactory position, for our exports during the eight months have amounted to 335,865 lbs., valued at £37,751, compared with 146,705 lbs., valued at £21,710, last year. Bacon and hams to the value of £6,903 were exported, against £5,725 in 1920.

Milk Records.—Up to the time of going to press only six owners of dairy cattle have asked for entry forms for the milk recording scheme outlined in our last issue. It should be distinctly understood that it is not essential that a cow entered for the milk records should be a pedigreed animal; many cross-bred cows give more milk than does a pedigreed cow. It is also not essential that the calves from recorded

cows be hand reared. If a cow rears her own calf the certificate would be endorsed to this effect. The advantages of keeping records are so obvious that it is surprising to find our progressive farmers so slow in realising them, and it is to be hoped that further applications for forms will be forthcoming.

The demand for bulls from recognised milk strains is very great, and it is evident that a farmer who keeps records will be able to dispose of his young bulls at a much higher figure than will be paid for those bred by owners of non-recorded cows.

The Pig Industry.—The Large Black Pig Society at a meeting held in London on 22nd September decided to offer a championship cup for Large Blacks at the Bulawayo show. The generosity of the Society in donating this cup will be much appreciated by pig breeders in Matabeleland, and will, we feel sure, stimulate competition at the annual show.

Tsetse Fly, Masetter District.—Mr. J. K. Chorley, Assistant Entomologist, is at present in the Masetter district investigating the origin of cases of trypanosomiasis of cattle which have occurred on some farms in the neighbourhood of the eastern border. Deaths of cattle have been occurring annually for some years past, although tsetse fly has not as yet been seen on the Rhodesian side of the border. Two different species are, however, known to occur a few miles over the border in Portuguese territory. An area on the Rhodesian side of the border has been declared an open shooting area in which all classes of game may be shot without a licence.

Rhodesian Leather.—We are pleased to notice that the Rhodesia Leather Co., Ltd., whose factory is situated near Salisbury, has arrived at the producing stage and is offering sole leather for sale. The leather is supplied in "ranges," each range covering sufficient material to sole from two to three pairs of boots, the cost varying from 3s. 6d. to 5s. 6d. per range according to its size and substance. We believe that the leather produced is of excellent quality, and there would appear to be no reason why all our requirements of sole leather should not be met from this local source. If any difficulty is experienced in obtaining the leather, representation should be made to the Manager, Box 364, Salisbury.

The company is starting in a modest way, preferring to establish itself thoroughly before committing itself to any ambitious project, and in this we think it is well advised. There is great scope for a company of this kind, and we look forward to the time when all leather goods used in this country will be made from Rhodesian leather.

Water Power Resources of Southern Rhodesia.

By C. L. ROBERTSON, B.Sc., A.M.I.C.E., Hydrographic Engineer.

It is proposed in this memorandum to broadly review the hydrographic conditions of Southern Rhodesia and delimit certain specific areas which are worthy of detailed investigation as potential sources of water power. The means by which it is intended to secure this detailed information are also given.

TOPOGRAPHY.

Southern Rhodesia extends from the Zambesi to the Limpopo Rivers, between approximately 16 degrees to 22 degrees south latitude and from 25 degrees to 30 degrees east longitude on the Bechuanaland border to 33 degrees east longitude on the border of Portuguese East Africa. Its approximate area is 153,000 square miles. The main topographical feature of the country is the narrow central plateau, 4,500 to 5,000 feet altitude, which traverses the country in a north-easterly direction from Plumtree to Gwelo, thence east to Umvuma, north to Marandellas, and again east till it links up with the eastern border mountain chain near Inyanga. The eastern border is bounded by a definite mountain range 6,000 to 8,000 feet altitude, running in a north-south direction. In the Inyanga and North Umtali districts the border is 15 to 20 miles beyond the escarpment. In the South Umtali and North Melssetter districts the boundary is nearer the escarpment, and for some distance is along the divide. Along the northern and southern extremes of the eastern border the country is low-lying and under 1,000 elevation. The main drainage of the country escapes through this area.

There is another subsidiary plateau extending from Marandellas in a north-west direction past Salisbury to the Umvukwe Hills, approximately 6,000 feet high, which run north and link up with the Zambesi escarpment. The Zambesi escarpment, approximate elevation 3,500 feet, is a feature of the northern portion of the country. It is distant about thirty miles from the northern border, but is not continuous throughout. The altitude of the northern border bounded by the Zambesi is 3,000 feet at Victoria Falls to approximately 1,200 feet at Feira. The altitude of the southern border bounded by the Limpopo is approximately 1,600 feet below Tuli to 900 feet at the Portuguese border.

HYDROGRAPHIC CONDITIONS.

These topographical features divide the country into the following main drainage areas:—

Zone A.—The area including rivers draining from the main plateau and entering the Zambesi between Victoria Falls and Kariba Gorge.

Zone B.—The area including the rivers draining the main plateau and flowing into the Limpopo River.

Zone C.—The area including the rivers draining from the main and subsidiary plateau and entering the Zambesi between the Kariba Gorge and Feira.

Zone D.—The area including the rivers draining between the main plateau and eastern escarpment and flowing through the low country at northern extremity of eastern border.

Zone E.—The area including the rivers draining between the main plateau and flowing through the low country at southern extremity of eastern border.

Zone F.—The area including the rivers draining from the border mountain range and flowing east to the Portuguese border.

The approximate areas of these zones and mean rainfall are as follows:—

	Sq. miles.	Normal mean annual rainfall. Ins.
Zone A	34,900	24.3
Zone B	34,130	21.6
Zone C	34,335	30.6
Zone D	15,325	35.6
Zone E	32,730	33.9
Zone F	2,250	56.5
Total	153,670	

It is proposed to analyse the hydrographic conditions in these zones in detail in order to determine the potential water power possibilities in each. Before proceeding to do so, however, it is advisable to state generally the nature of the Rhodesian rainfall season, the extreme fluctuations above and below normal, of the annual rainfall in each zone and the general relation between dry period flow in the rivers and the previous season's rainfall. The rainy season in Rhodesia normally extends from October to the end of March. The period October to December is characterised by scattered showers accompanied by thunder-storms, during which the rate of precipitation is often intense, but the intervals between the rain periods are as long as two or three weeks. The hydrographic conditions during this period are very similar to those obtaining in the bulk of the Union of South Africa, viz., sharp floods, irregular river flow and low percentage of run-off. The period January to March is characterised by general rains extending over large areas. The intervals between the rain periods are

short, seldom amounting to more than one week in a normal season. The catchments remain saturated during the bulk of the period and result in a high percentage of run-off, continuous river flow at a high level in all rivers with catchments larger than 1,000 miles, and sustained floods. During the period April to September there may be occasional showers, but continuous or general rain is unusual. The normal flow in the rivers is usually well sustained during the period April to June, and gradually drops to a minimum towards the end of October. The following table shows the percentage of the annual rainfall occurring in these periods in the different zones:—

	April- September. Percentage.	October- December. Percentage.	January- March. Percentage.
Zone A	5.7	42.9	51.4
Zone B	6.0	38.1	55.9
Zone C	5.0	36.1	58.9
Zone D	5.6	32.0	62.4
Zone E	8.4	33.0	58.6
Zone F	12.2	24.9	62.9

In addition to these zones differing in the seasonal distribution of the rainfall, they also differ markedly in the fluctuations of the annual rainfall above and below normal.

The dry weather flow in all Rhodesian rivers responds markedly to the average rainfall on their catchments during the previous three seasons.

In the accompanying table is shown the smoothed three years' average rainfall in each zone for the period of the records. This smoothed three years' average is obtained from formula

$$\text{average} = \frac{a_1 + 2a_2 + 4a_3}{7}$$

where a_1 = rainfall during first year of series

a_2 = rainfall during second year of series

a_3 = rainfall during third year of series

This smoothed average is a useful index figure for indicating when absolute minimum flow was likely to have occurred in the different zones and the relative value of the isolated gaugings mentioned later, taken at different periods in the various zones.

Table Showing Relative Value of Different Zones for Winter Flow.

Season.	Zone A.	Zone B.	Zone C.	Zone D.	Zone E.	Zone F.
1900	22.49		34.36			
1901	24.93		37.99			
1902	28.49		36.35			
1903	23.16		26.85			
1904	22.90		27.20		35.39	
1905	19.48		27.51	27.08	29.24	
1906	21.01		27.45	25.64	30.41	
1907	27.05	20.11	32.44	30.00	39.00	
1908	25.97	21.28	29.54	31.93	36.20	
1909	30.50	24.15	33.56	38.20	33.69	
1910	25.10	23.88	31.15	27.18	25.69	
1911	27.88	21.45	32.04	40.22	32.25	
1912	23.30	16.89	25.36	33.95	29.52	
1913	17.96	12.05	28.34	31.71	30.30	
1914	16.06	11.88	27.21	24.99	24.77	46.13
1915	27.24	31.45	30.26	36.75	41.91	54.50
1916	22.10	21.58	25.66	27.98	25.12	48.62
1917	19.63	20.60	25.07	30.64	28.97	59.11
1918	27.50	25.82	32.74	44.69	47.19	89.33
1919	27.42	25.20	34.60	41.93	41.27	75.00
1920	27.84	24.29	34.18	45.51	37.34	61.90
1921	27.09	24.27	34.36	39.06	29.80	51.98

A number of gaugings exist of river flow taken at various points of the river systems in these zones for the period 1914 to date. In addition, a number of gaugings were made in Zones D, E and F by Mr. W. B. Gordon in the winter of 1906. The above table makes it evident that this period probably covers the period of absolute minimum flow in all the zones. A study of these gaugings makes it evident that there is a long period of non-flow in seasons when the index figure is under 20 and the minimum flow is very small in seasons when the index figure is under 25 and is only approx. of the order of magnitude of $\frac{1}{2}$ cub. ft. per second per 100 square miles of catchment.

In the present analysis the following principles have been adopted:—

(1) *Storage*.—Owing to the lack of cheap storage facilities in Rhodesia it is assumed that power schemes here will only depend to a limited extent on storage to tide over periods of low flow and will never be solely dependent on storage. The Mazoe Dam has a storage capacity of 800 million cubic feet approximately, and the cost of storage was £150 per million cubic feet stored. Further investigation may disclose more favourable sites in this country, but for the present this is assumed as unlikely.

(2) Only possibilities of a minimum of 200 h.p. and over can be considered.

(3) *Streams without Storage*.—The absolute minimum flow is taken as the minimum working discharge, and the maximum working discharge is four times the absolute minimum flow which will be available for eight months in any year.

(4) *Streams with Limited Storage*.—Storage is reckoned to be required for a period of 150 days. For reasons previously stated, the probable storage capacity available will probably only be in the order of 500 million cubic feet. Fifteen per cent. storage losses are assumed during this period, allowing 450 million cubic feet for power purposes, or approximately a constant flow of 30 cusecs during this period.

Cost of Storage is taken as £200 per million cubic feet owing to the adverse Rhodesian conditions.

Cost of Aqueducts in this case is reckoned as £100 per cusec for first mile and £25 per cusec for every other mile owing to easier country being probable.

(5) The formula E.H.P. $\frac{Q \times h}{10}$

Q in cubic feet per second,
h effective fall in feet,

has been used for calculating the horse power available.

(6) A capital cost of £50 per horse power is assumed to be the maximum allowable cost on rivers with storage (exclusive of cost of plant and buildings). Similarly, a capital cost of £25 per horse power is assumed to be the maximum cost allowable on rivers without storage (owing to the higher proportion the cost of plant, etc., will bear to total cost).

With these assumptions the following two tables have been drawn up showing what factors of flow and effective fall must obtain in any area before it can be considered as an area of potential power development.

Table I.—For rivers without likely storage possibilities.

Table II.—For rivers with storage possibilities.

TABLE I. (No storage.)

Class.	Absolute minimum flow, 4 months.	Maximum working discharge, 8 months.	Average flow available.	Effective fall necessary in			
				Short distance.	5 miles.	10 miles.	20 miles.
	Cusecs.	Cusecs.	Cusecs.				
A	1	4	3	667	—	—	—
B	2	8	6	333	—	—	—
C	4	16	12	167	—	—	—
D	5	20	15	133	110	180	300
E	10	40	30	67	110	180	300
F	20	80	60	33	110	180	300
G	50	200	150	13	110	180	300
H	75	300	225	9	110	180	300
I	100	400	300	7	110	180	300
J	Over 100	—	—	—	110	180	300

TABLE II. (With storage.)

Class.	Average minimum flow, 4 months.	Low flow, 4 months.	Minimum working discharge, 4 months.	Low flow, period 4 months.	Maximum working discharge, 4 months.	Average flow during year.	Effective fall necessary in		
							5 miles.	10 miles.	20 miles.
	Cusecs.	Cusecs							
A	Nil	2	18	20	72	36.6	630	680	78
B	5	10	23	28	92	47.7	505	555	65
C	10	20	28	38	112	59.3	420	470	56
D	15	30	33	48	132	71.0	365	410	50
E	20	40	45	45	180	90.0	310	360	46
F	30	60	60	60	240	120.0	255	310	41
G	40	80	80	80	280	146.6	220	270	36
H	50	100	90	100	360	183.3	200	245	34
I	100	200	140	200	560	300.0	150	200	29

With the help of these two tables it will be possible to analyse broadly the different river zones and determine in which areas the requisite conditions are likely to be fulfilled.

Zone A includes the Gwaai River system with its tributaries, Khami, Bembesi, Shangani and Gwelo Rivers. The rivers flow deep, sandy beds with only a small perennial flow in normal years. During the season 1913 and 1914 they were known to have no flow some months, even in their lower reaches. The average grade of main river systems is only 12 feet per mile throughout, and no rapids are known in the area. Good storage sites are likely to exist in the area, but they will probably be utilised for irrigation development only. The rivers can only be considered as coming under Class A in Table II., and there is no likelihood of the necessary conditions being found available. The whole area may therefore be discarded for potential power possibilities.

Zone B includes Shashani, Tuli, Umzingwane, Bulyebe and Nuanetsi Rivers, draining the south-eastern slopes of the main divide. The upper portion of this zone is rugged and broken, there being a descent of approximately 2,000 feet in 40 miles from the Matopos to the level plains extending to the Limpopo. The rainfall table shows that the whole area is subject to long periods of low rainfall. The rainfall in the upper portion of the area is, however, about 50 per cent. in excess of the average for the whole zone.

The Shashani and Tuli Rivers have a number of tributaries draining from this upper area with grades of 40 to 60 feet per mile. The flow in these tributaries is minor, however, as is shown by a gauging of the Ove River, one of the most important of these tributaries, taken below the broken country in May, 1918. The flow was only seven cubic feet per second in the early portion of a season which, as shown by the rainfall table, was the second-best on record. The flow in these streams is certain to have been practically nil during the major portion of seasons 1912 to 1914. As storage sites of the necessary magnitude are unlikely in this area, it may be discarded as having no potential power possibilities.

The rivers in the remainder of the zone have an average slope of only 10 to 15 feet per mile, and are known to have had no flow during a portion of the seasons 1913 to 1914. They therefore come under Class A in Table II., and there is no likelihood of the necessary fall conditions being found available.

Zone C.—This comprises two main river systems, viz., the Sanyati system and the Angwa-Hunyani system, draining the north-westerly slopes of the main divide and discharging into the Zambesi.

Sanyati System (a). The Umniati River has a fall of 1,000 feet in the first 70 miles of its course to the railway bridge. In the area above the railway the river flows in a broad channel with pools $\frac{1}{4}$ to $\frac{1}{2}$ a mile in length and sharp falls of 5 to 10 feet between the pools. The flow in the Umniati at the railway bridge is known to have been under 1 cubic foot per second towards the end of the seasons 1916 and 1917, and a normal flow at the most of not more than 5 cubic feet per second during these seasons. Below the railway the Umniati traverses a gently sloping plateau through which the river flows in a deep valley. The fall in this area to the junction with the Umfuli River is 850 feet in 70 miles. This area has not been investigated in detail for irrigation possibilities, but any large development would depend on storage works above the railway to command the land on the plateau. The river at best can only be considered as Class B in Table II., and the necessary fall is unlikely to be available.

(B) *The Umfuli River* has its source in country at an average elevation of 5,200 feet. The fall to the railway bridge is approximately 1,500 feet in 80 miles. The nature of the river channel is similar to the Umniati, but the area drained has a higher average rainfall. Its normal flow is therefore larger than the Umniati, but the absolute minimum flow in 1917 was also under 1 cubic foot per second at the railway bridge. Beyond the railway the Umfuli River traverses the gently sloping plateau between it and the Umniati on the left bank; the country on its right bank rises sharply to the divide between the Umfuli and Hunyani catchments. The through fall in this section is 1,000 feet in 60 miles, and a steeper grade of 250 feet in the 10 miles above the Umniati junction. The Suri-Suri River is the only important tributary in this section. The river at best can only be considered as Class C in Table II., and the requisite fall is not available.

(C) *The Sanyati River*, from the junction of the two rivers to its

confluence with the Zambesi, has a through fall of 1,100 feet in 80 miles. Nothing is known in detail about the river flow in this section. The river flows in a deep valley approximately 1,500 feet below the level of the Lomagundi plateau on its right bank, which is drained by the two important tributaries the Piriwiri and Tengwe Rivers. The river has cut its valley deep below the level of the escarpment where it passes through, but the grade in this section is known to be steeper than the through grade. The river here may be safely considered as of Class E in Table II., and there is a possibility that an effective fall of 460 feet in 20 miles may be found available. This section is therefore just sufficiently promising to warrant detailed investigation, which should include a reconnaissance of the area and continuous gauging records of low flow, which should be obtainable without difficulty immediately below the Umfuli junction. The possibilities here if these factors are proved to exist are a minimum of 2,000 to a maximum of 8,000 h.p.

Hunyani-Angwa System (a). The Hunyani River rises at an altitude of over 5,000 feet and flows westwards to the railway line with a fall of approximately 900 feet in 50 miles. After passing the railway line, it continues to flow west for some distance and then runs north past Sinoia. In this section its slope is still flatter, being only 500 feet in the 75 miles to the railway bridge at Sinoia, and a further 300 feet approximately up to its junction with the Maquads River 20 miles further on. In this section the river is characterised by long pools with sharp falls of from 5 to 15 feet between the pools. In this section the following records exist of minimum flow, viz., 8 cubic feet per second at drift near Sinoia at beginning of September, 1906. The rainfall table shows this was a period of only comparatively low river flow as compared to the minimum in 1917. The flow at the railway bridge near Salisbury at the end of September, 1915, an average year as shown by the rainfall table, was only 3 cubic feet per second, and an absolute minimum of under $\frac{1}{2}$ cubic foot per second in October, 1917. Good storage sites are available on this section, but the river up to the Maquads junction can only be considered as of Class B in Table II. There is no likelihood of power possibilities, as the effective fall is not available.

From the Maquads Junction to the junction with the Angwa River there is a fall of approximately 2,000 feet in 90 miles. The river is known to have a steep grade where it passes through the escarpment to the Zambesi Valley, but the actual grade has not been observed. In this section the Hunyani is joined by two strong perennial tributaries, viz., the Maquads and Mesitikwe Rivers, which enter above the escarpment and drain the Umvukwe Hills, on which the average rainfall is over 35 inches and the minimum rainfall is 23 inches. No records exist of the flow of the river in this section, although it is stated to have had a very low flow near its junction with the Zambesi in October, 1914. The river, however, may probably be placed in Class D, Table II., with the possibility of a fall of 800 feet in 20 miles being found available at the escarpment. This area will certainly repay investigation, and a gauging station should be installed above the

Mesitikwe junction, this being the nearest point from which records would be obtainable. On conditions assumed probable, there should be available here a minimum of 2,600 and a maximum of 10,400 h.p. within the cost limits previously laid down.

The Angwa River rises on the Lomagundi plateau at an elevation of over 4,000 feet. The grade of the river on the first forty miles is only 20 feet per mile. Where it passes through the escarpment the grade is much steeper and there is a through fall of 1,000 feet in 25 miles. The river has long periods with no flow in dry years, and can only be regarded as in Class A, Table II. The power possibilities, therefore, are not very good, but the area near the escarpment might be worth investigating in more detail. Continuous gauging records near the escarpment, however, are not possible. There is possibly available here a minimum of 1,400 h.p. and a maximum of 5,600 h.p.

Zone D comprises the rivers draining north-east to the Portuguese border. There are two main river systems in this area, viz., the Mazoe and the Ruenya River systems.

The Mazoe River, from its source near Salisbury to its junction with the Umrodzi River, passes through an area of extensive irrigation possibilities. A storage dam of 800 million cubic feet capacity has been constructed at Mazoe Poort, and all the water stored will in time be utilised for irrigation. The normal flow at Mazoe Poort has fluctuated from $\frac{1}{2}$ cubic foot per second in 1914 to 13 cubic feet per second in 1918. There are no power possibilities in this section.

The Umrodzi River is a more important river than the Mazoe above the junction, and drains the area between the main divide and Umvukwe Hills. The Umrodzi system comprises three perennial streams, viz., Umrodzi, Garanapudzi and Wengi. The Umrodzi River between the junction of the Garanapudzi River and Wengi River has a fall of 170 feet in 10 miles. Its absolute minimum flow was 2 cubic feet per second at end of October, 1914. Fairly numerous records of its flow exist, and it may be classified as Class B in Table II. There are no potential power possibilities in this section.

The Wengi River, draining direct from the Umvukwes, is the main feeder of the Umrodzi River. Its absolute minimum flow was 5 cubic feet per second at beginning of November, 1914. A fall of 300 feet in six miles is available above the junction. There are moderate possibilities of storage above this section, but storage here is unlikely to be found justifiable if utilised for power development alone. For the present, therefore, this river can be regarded as in Class D, Table I. There may be available an average of 450 h.p. with a minimum of 150 h.p. for four months in certain years. Details of river flow are being obtained from a gauging station near the junction installed last year. The possibilities of storage above the section should also be investigated in detail.

The Mazoe River below the Umrodzi junction has a fall of 500 feet in 25 miles up to the junction of the Poorti River. The

absolute minimum flow in this section was 8 cubic feet per second November, 1914. The irrigation possibilities in the area are good. From the Poorti River junction to the Inyagui River junction the grade is steeper, the through fall being 600 feet in 16 miles. This section, with a fall of 100 feet in $1\frac{1}{2}$ miles, is known. The river in this section is in Class E, Tables I. and II., and therefore has poor irrigation possibilities, but it is probable that its minimum flow will in time be utilised for irrigation purposes above this section. It is, however, sufficiently promising to be kept under observation, and has the advantage of being near a mining area. A gauging station is being installed immediately below the section this year. The present possibilities are (effective fall, 400 feet in 10 miles) without storage minimum 400 h.p., maximum 1,600 h.p. (eight months); with storage minimum 1,800 h.p., maximum 7,200 h.p. (four months).

The Inyagui River System above its junction with the Mazoe River includes the Umwindsi, Inyagui and Shawanoya, which drain the slopes of the main divide and flow north to the Mazoe River.

The Umwindsi River is fairly well known throughout. In the first 12 miles of its course it has a fall of 500 feet, 200 feet in the next 10 miles, and approximately 900 feet in the last 25 miles above the Inyagui junction. In the first 20 miles it flows through a good irrigable area, and the whole of its minimum normal flow has been apportioned for irrigation purposes. The river in the last section cannot therefore be regarded as other than Class A, Table II., and it is doubtful whether the lie of the country will permit of the available fall being utilised. The area should, however, be investigated for a storage site and an effective fall available defined. A gauging station is being installed above the section this year. The rather doubtful possibilities in this area are of the following order: Minimum 1,400 h.p., maximum 5,600 h.p. (four months).

The Inyagui River below the junction of the Shawanoya River has a bigger normal flow than the Umwindsi River. In addition, the irrigation possibilities in its upper area are limited. It may be regarded as a river in Class B, Table II., and with the possibility of an effective fall of 650 feet in 20 miles being available (a through fall of 1,400 feet is known in the 35 mile section above Umwindsi junction). The area above the Umwindsi junction should be investigated for a storage site and details of effective fall available. There is probably here power development of the following order: Minimum 1,500 h.p., maximum 6,000 h.p. (four months).

Details of flow available will only be obtainable from Shamva Mine pumping station below the junction. Below the junction of the Umwindsi River to the Mazoe River there is an available fall of 700 feet in 25 miles. If storage sites are found in the two rivers above the junction and utilised for power development, there will be available on this section a minimum working discharge of 40 cubic feet per second and a maximum working discharge of 160 cubic feet per second.

This will probably permit of the development of a minimum of 2,800 h.p. and a maximum of 11,200 h.p.

The Mazoe River below the junction of the Inyagui River is uninvestigated. There is known to be a through fall of 1,400 feet in the 70 miles to the border, and the river in its lower reaches has been reported on as having a flat grade. It is extremely probable, therefore, that on the 20 mile section below the Inyagui junction there will be available an effective fall of 500 feet in 20 miles. The section should be investigated for details of effective fall available. If utilised in conjunction with the three possible power storage sites enumerated above, there will be available here a minimum working discharge of 85 cubic feet per second and a maximum of 340 cubic feet per second. The power possibilities here would then be of the following order: Minimum 4,250 h.p., maximum 17,000 h.p.

The Ruenya River System comprises the two main rivers, the Nyagadzi and Inyagombie Rivers.

The Nyagadzi River drains the northern slopes of the main divide between Macheke and Headlands. The fall of the country up to the junction of the Inyagombie River is approximately 2,500 feet in 70 miles. No details of the grade of the river, however, are known, but facilities for storage are not very probable. No records of its flow are available, but it is probably a river of the type Class E, Table I., in its lower reaches. The area above the junction of the Inyagombie River might be worth investigating, but the potential power available will only probably be of minor magnitude, viz., 400 h.p. minimum, 1,600 h.p. maximum. The area is remote from the settled portion of the country, so continuous gauging records will not be available.

The Inyagombie River drains the western slopes of the Inyanga mountains, on which the normal annual rainfall is 60 inches, and receives numerous tributaries on the left bank which drain the northern slopes of the main divide, on which the normal annual rainfall is 40 inches. The river, even in its upper reaches, has a strong permanent flow. From a point eight miles below its source to its junction with the Sihla River nine miles further on it may certainly be placed in Class E, Table I. A fall of 1,100 feet has been observed on this nine mile section. The nature of the country will permit of 1,000 feet of this fall being utilised. The potential power available in this section is therefore 1,000 h.p. minimum, 4,000 h.p. maximum. A gauging station should be installed in this area. The records will probably prove that the river can be placed in a higher category. Below the junction of the Sihla River to the junction of the Nyagadzi River there is a through fall of approximately 2,000 feet in 50 miles. A gauging of the river in this section at end of August, 1917 (smoothed three years' rainfall average in catchment area, 27.90), showed a flow of 94 cubic feet per second. It will be safe, therefore, to regard the river in this section as in Class F, Table I. The area should be investigated for detailed information as to fall available. It is probable, however, that 1,500 feet of the available fall could be ren-

dered effective in five 10-mile sections. This would permit of the development of 3,000 h.p. minimum and 12,000 h.p. maximum (eight months). A gauging station could be installed below the junction of the Sihla River.

The Ruenya River below the junction of the two rivers is wholly uninvestigated. It can probably be placed in Class G, Table I. There are probably localities in which effective falls of 20 to 30 feet are obtainable in a limited distance, but no details are known. The whole area would, however, justify detailed investigation. It is impossible to state at present the magnitude of the potential water power available.

(To be concluded.)

Infectious Abortion of Cattle and its Possible Relation to Human Health.

A paper read by Mr. L. E. W. Bevan, M.R.C.V.S., Government Veterinary Bacteriologist, Fellow of the Royal Society of Tropical Medicine and Hygiene, before a meeting of the Southern Rhodesia Veterinary Association, 12th November, 1921, at which were present by invitation members of the medical profession.

This meeting of the Southern Rhodesia Veterinary Association has been convened in order that its members may again discuss the very serious disease of cattle known as infectious, contagious or epizootic abortion, which since our last meeting has assumed alarming proportions in this country; and in view of the recent suggestion that the disease may be infective to man, the members of the medical profession have been invited to assist in our deliberations.

The close association and interdependence of our two professions is daily becoming more noticeable, especially in tropical and sub-tropical countries where the diseases of man and animals are so closely allied. Undoubtedly the best and most scientific manner of studying such diseases is from the comparative standpoint, and the subject of

my paper to-night affords an example of the necessity for co-operation between us.

For my part I have to bring before you certain aspects of the disease as it occurs among animals in this Territory, but in the course of my remarks I may throw out hints which it is hoped may prompt the members of our sister profession to enter into the debate and to bring forward any information they possess having a bearing upon the disease as it affects the human population of this colony.

There is no doubt that the future prosperity of Rhodesia principally depends upon the progress of the pastoral industry, but it is sad to relate that since the advent of the white man, the herds of this country have twice been decimated by bovine scourges. On the arrival of the Pioneers it is said that the country was "rolling with cattle," but in 1896 the greater number of them was destroyed by rinderpest, which passed through this country on its way to the south. Notwithstanding this disaster the survivors, in the words of the Bible, brought forth their thousands and tens of thousands, until the industry was again upon a sound footing, only to be again destroyed by East Coast Fever, which arrived in 1901, and has only recently yielded to the scientific efforts of the Veterinary Department.

At the present time it is officially stated that there are about one and a half million head of cattle in the country, owned equally by black and white, but alas, the industry is again threatened with a new disaster in the appearance of this insidious and costly malady known as infectious abortion, a disease which is now known to exist in all parts of the Territory.

The first outbreak recorded in this country was in a dairy herd in Salisbury in 1906. This was promptly and vigorously dealt with and was apparently stamped out. Although abortions undoubtedly continued to occur, they were not reported to the Veterinary Department, and it was impossible to determine whether infectious abortion as a specific disease was the cause of them until 1914, when the agglutination test was first applied as an aid to diagnosis. Since then it has been found to exist from Umtali in the east, through Rusape, Marandellas, the Beatrice district, Enkeldoorn, Umvuma, Gwelo, Shangani, Bulawayo and north to the Lomagundi district. In fact it is probable that it exists in cattle belonging to Europeans and natives alike throughout the country. It is equally prevalent in Northern Rhodesia, and as far as one can gather, throughout the Union of South Africa.

This disease is not confined to Africa. In Great Britain it is second only in importance to and probably more prevalent than tuberculosis. In America it is stated by the Bureau of Animal Industry to be the cause of the loss of many millions of dollars yearly through its presence in dairy and range cattle. In New Zealand the losses in dairy products directly and indirectly attributable to it are estimated at £300,000 per annum.

In many ways this disease affects the human population of this country. The last census revealed a somewhat lamentable state of affairs and a population of a little more than 33,000 white people. A

great proportion of these are dependent upon the cattle industry, and I doubt very much whether after his sad experience in the past, the Rhodesian settler, however stalwart he may be, can "stand up" to another disaster. And if it is found that this disease of cattle is infective to human beings, the situation is fraught with grave dangers, and we, the guardians of the public health, are faced with a grave responsibility if we wish to see Rhodesia, our adopted country of which we are so proud, survive the storm.

It has long been known that abortions, even in such numbers as suggest some common cause, were apt to occur among domestic animals, and various reasons were advanced to account for them, as for example, feeding upon ergotised pasture, sewage poisoning, mechanical injury, over exertion, fright or sympathy; but as long ago as the beginning of the last century certain keen observers maintained that "an infection was the causative agent." The correctness of this view was proved later in the century, when abortion was artificially produced by the introduction of vaginal discharge and foetal membranes into the vaginas of healthy cows. It was not, however, until 1896 that Bang and Stribolt demonstrated the specific cause to be a bacterium known as the *Bacillus abortus* of Bang, and, having cultivated this organism, in bringing about abortion by the injection of pure cultures into the vagina of pregnant cows and ewes. Also injections of cultures into the circulation produced similar results. Later McFadyean and Stockman demonstrated what is of still greater practical importance, that pregnant animals could be infected by feeding upon infective material, either artificial cultures or natural exudates from infected animals. In these cases artificially produced, the characteristic lesions of the disease were met with, and the bacillus could be recovered from the exudate of the foetal membranes, the diseased cotyledons, and the intestinal contents of the aborted fetus.

It is probable that the organism had been noted by previous observers, but it remained with Bang to isolate the bacillus which required for primary cultures not only a specific medium consisting of nutrient agar to which liquid gelatin and sterile liquid blood serum had been added, but also an optimum growth temperature of 37° C., and a special oxygen content indicated by the fact that the colonies develop in a definite stratum a few millimetres below the surface. The *Bacillus abortus* is thus not a strict anærobie, but has been classified as a micro-aerophile.

Various devices have been made use of in order to establish a primary culture and to afford the special oxygen requirements. But it would appear that in sub-cultures the organism can accommodate itself to ordinary aerobic conditions. Under such conditions surface colonies develop in about three days as small, usually discrete honey-like dots. These latter tend to coalesce and to form a creamy film which in time becomes darker in colour, and in very old cultures is actually coffee-coloured or brown.

The medium upon which the strain used in our laboratory, and to which the organism appears to have become well accommodated, is prepared as follows:—

Lemco, 5 gm.
Sodium chloride, 5 gm.
Peptone, 10 gm.
Agar, 27½ gm.
Water, 1 litre.
Glycerine, 3 per cent. added to the filtered medium which has previously been rendered alkaline.

Surface growths upon this medium are well established in three days, and fully developed growths suitable for vaccine are available within a week. A certain degree of moisture favours the growth, and for vaccines it has been found necessary to conserve in a special manner the water of condensation. Too much moisture, however, alters the cultural characteristics of the growth and the properties of the organism.

The *Bacillus abortus*, both in natural and artificial conditions, tends to collect in clusters, and these are to be met with in the affected chorion, cotyledons, characterised exudate and discharges, and in the stomach of the foetus. They are stained readily by basic aniline dyes, but in the clusters the morphology is difficult to define. The term coccobacillus has been used to describe the organism from the fact that coccoid and elongated coccoid or bacillary types are met with.

Some difficulty is experienced in establishing primary cultures, chiefly on account of the peculiar oxygen requirements of the organism. Several ingenious methods have been devised to cope with this, for example, suspected material is sown on a medium which is placed in a closed jar with other tubes containing common aerobic organisms which exhaust the oxygen until the stage when the *Bacillus abortus* finds the atmosphere congenial. This method is made use of to separate the *Bacillus abortus* from other organisms with which it may be associated in septic discharges; but perhaps the best method of obtaining a pure culture is to inoculate suspected material into guinea-pigs, when the *Bacillus abortus* becomes established in the spleen, which becomes enlarged, and sometimes after two or three months, beset with tubercles. In a few weeks, however, the organism is present in the spleen in pure culture, and in such numbers that when small pieces of spleen substance are spread upon agar slants, a characteristic growth can be obtained. This method has proved useful in demonstrating the presence of the specific micro-organism in the udders and milk of apparently healthy cows acting as "carriers" of infection.

In 1918 Evans pointed out a close relationship between the organism responsible for infectious abortion of domesticated animals and the so-called *Micrococcus melitensis*, the cause of the well-known undulant or Malta fever in man. More recently Meyer and Shaw have stated (*Jl. Infect. Dis.*, 1920. Sept. Vol. 27, No. 3, pp. 173-184) that "on morphological grounds the organisms of undulant fever and infectious abortion of domesticated animals must therefore be considered as identical," and suggest that a genus for which they propose the name "Brucella" be created in the family *Bacteriaceae* to separate and distinguish properly these important micro-organisms.

The serum of animals affected with infectious abortion will agglu-

tinate the *B. abortus*, and in 1914 Bevan was able to demonstrate that the serum of cattle suffering from the disease in Southern Rhodesia would agglutinate strains of *B. abortus* obtained from Great Britain, the Union of South Africa and British East Africa. Similarly, serum from natural cases of infection in British cattle would cause agglutination in emulsions of these strains. This observation suggests that the causal organism of bovine abortion in Southern Rhodesia is similar or identical to the *Bacillus abortus* causing the disease in other parts of the world, a matter of some importance, as will be seen later. It is probable, however, that there are different strains of the organism of varying virulence, just as there are strains of the *M. melitensis*; and it is conceivable that there may be a certain overlapping of strains of the two organisms.

In February last a patient from the Shamva district was admitted to the Salisbury Hospital, and his serum was obtained by Dr. Peall and tested by Bevan against cultures of *Bacillus abortus*, with which it caused rapid and marked agglutination in dilutions of 1 in 200. This I believe was the first demonstration of a co-relation between the abortion of cattle and undulant fever of man in this country. The test was prompted by an article by Feusier and Meyer, in which they showed by serological tests a close association between *Bacillus abortus* and *M. melitensis*, and pointed out that certain strains of *M. melitensis* bore a closer relationship to the abortion bacillus than to other strains of *melitensis*. They also demonstrated that "the serums from cows and hogs suffering from natural abortion disease may also re-act to both *B. abortus* and *B. melitensis* organisms."

Recent observations by Orpen, working in the laboratory of the Medical Department, and by Bevan, working independently, reveal a very serious state of affairs in this country, if serological tests and cross agglutination re-actions are to be regarded as indicating any corresponding pathogenicity of the organisms.

The possibility of such an association has engaged the attention of numerous observers for many years past in other parts of the world, and in July, 1916, Cooledge in the *Journal of Medical Research* reviewed the experiments made up to that time by several observers. Mohler and Traum obtained cultures from guinea-pigs inoculated from the tonsils and adenoids of 56 human beings, and obtained from one case distinct lesions of infection in the liver, spleen and testicles, from which the *Bacillus abortus* was recovered.

Larsen and Sedgwick made an extensive study of human infection by this organism. They examined the blood of 425 children, and obtained 73 positive re-actions by the complement-fixation method. They also found that an infant taken from the breast on the 7th day after birth and fed on cow's milk gave a positive re-action on the 21st day. Cooledge himself examined the blood sera of 14 persons drinking raw milk, pasteurised milk, or no milk, and found that of the persons who had been taking raw milk or cream previous to the test, three (or 50 per cent.) gave a re-action to the complement-fixation and agglutination tests. One woman, whose blood re-acted to the test, had been drinking milk which was found to contain *Bacillus abortus* anti-bodies, and had been drawn from one quarter of a certain cow. One man,

whose serum gave a partial agglutination at 1 in 100, had been drinking about a pint of raw cream daily during the summer. These results satisfied the author that the presence of anti-bodies in human sera is due to the ingestion of infected milk, and may indicate either active infection or merely a passive immunity due to the absorption of anti-bodies from the milk, and he adds, "We have no proof that *bacterium abortus* (Bang) is pathogenic for human beings." No reference is made in these reports to any symptoms in these re-actors suggesting undulant fever; nor are we told whether abortion at any time took place among human females fed upon infected milk.

It should be remembered that in natural conditions abortion due to this organism is essentially a disease of cattle, and it is stated by the Departmental Committee appointed in 1905 by the Board of Agriculture and Fisheries to enquire into Epizootic Abortion, that it had no hesitation in stating that it believed at least 99 per cent. of the outbreaks of cattle abortion which assumed epizootic characters to be due to infection by the bacillus of cattle abortion.

Mares, sheep and swine may also become infected with the bacillus of Bang under natural conditions and by artificial methods. Goats, guinea-pigs and rabbits have also proved susceptible, and it may well be that the human female is not exempt.

Natural infection occurs by the vagina or by the mouth. It is probable that ingestion is the most common method. The bull is occasionally a mechanical transmitter of contagion, and it has been shown that the organism may become localised in the vesiculæ seminales, deferentia, testes and epididymides of the male, which may thus become a carrier of infection.

The symptoms in cattle may be briefly described. The disease is generally most severe in heifers and young cows, but may attack a susceptible animal of any age and at any stage of gestation. It is said that "the majority of cases of 'visible' abortion occur between the 5th and 7th month of gestation; the average period is probably between the 5th and 6th month, if a reliable estimate of the early or invisible abortions could be made. Some cows abort about the 1st or 2nd month, and no suspicion is aroused until œstrum recurs a few days later." (Ainsworth Wilson.) The suspicion that animals may frequently abort un-noted is confirmed by our observations in the country.

The course of the disease is insidious, and its existence is often unsuspected until the shortage of calves draws attention to its presence. In this country the diagnosis is confirmed by a special modification of the agglutination test.

The act of abortion is generally easy. Premonitory symptoms may or may not be present, and in many cases the fact that abortion has taken place is only detected by the discovery of the foetus or by a peculiar yellow flocculent discharge which soils the tail and hind parts, or by the retention of the after-birth, which is a very frequent sequel. Particular attention may be drawn to the fact that there is no appreciable effect upon the animal's general health and condition; that is to say, febrile disturbance, anæmia, rheumatic pains or indications of neuritis have not been observed. Pathological changes are almost

entirely confined to the uterus and to its contents. The mucous membrane may be in a state of catarrh and a typical exudate may cover the chorion. This is somewhat characteristic, being of a lightish yellow colour varying to dark brown. The membranes may be oedematous, and the cotyledons may be swollen, and occasionally necrotic. The foetus frequently appears quite normal; it is sometimes mummified but is rarely putrid.

The disease may be regarded as a disease of the foetal membranes. If the animal is not pregnant the organism can produce no pathogenic effects, and it is known that in apparently healthy animals the udder may be heavily charged with abortion bacilli, without harm to the animal until it becomes pregnant, when the organism may again make its way to the uterus. Schroeder and Cotton record that "a number of calves produced by cows with infected udders were killed immediately after they were born, and their bodies tested for the presence of abortion bacilli through guinea-pig inoculation methods. It was found that such calves—those that were delivered alive and seemingly healthy and vigorous—may harbour abortion bacilli in their stomachs and gastro-hepatic lymph glands, but invariably, when the calves were infected, the after-birth and uteri of the dams were also infected." Animals which thus harbour the organism in their udders are a constant source of danger, certainly to cattle, possibly to man. They act as "carriers," and may be the means of infection of a perfectly clean herd, or of re-infection in a herd which in the course of time has become clean. So long as such animals are in lactation the bacilli may be excreted in the milk. If the human subject is liable to a disease caused by this organism this source of infection is of considerable importance.

Let us now compare the symptoms of Malta fever in goats. The following description by Dubois is quoted by Edwards in a most comprehensive paper read by him before the National Veterinary Medical Association, to which I am largely indebted for many of the details I have brought before you. Dubois writes, ". . . in the goat there are as a rule no visible symptoms, and the animals maintain to all appearance their good health, the onset of the disease always passing unnoticed. . . . The most important symptom, and the one that would always make one suspect Malta fever, is abortion, but even that is not constant nor is it diagnostic. When the disease makes its appearance in a herd for the first time, the percentage of abortions may be anything from 50 to 90 per cent. of the pregnant goats. If these goats are again served, abortion occurs again, but the percentage is not so great as on the first occasion. Abortion may cease completely in a herd, but this does not make the danger any less, as a certain number of animals always harbour the parasite. Sterility is rarely observed. In the sheep the symptoms shown closely resemble those in the goat, and, as in the goat, abortion is the most important symptom. In all animals, independently of the clinical symptoms, the blood serum, urine and milk possess agglutinating powers for *Microroccus melitensis*. The value of the (agglutination) test (in diagnosis) is indisputable, but since the serum may retain its agglutinating power for years after all trace of infection has disappeared, a positive result only indicates that the animal is or has at one time been affected."

Thus we see that *M. melitensis* causes in certain of the lower animals a disease similar to that caused by *B. abortus* in cattle. But it also gives rise to a disease in man characterised by entirely different symptoms. In Rhodesia a number of cases have recently occurred among human beings who have shown the clinical manifestations of Malta fever, but as far as can be ascertained have not imbibed goat's milk, but have resided on farms where infectious abortion of cattle is known to exist. Circumstantial evidence therefore points to infection through infected cattle, but direct proof is not yet available. The object of this meeting is to compare notes in order that the members of the two professions may combine in investigating, and, if necessary, eliminating this danger.

The most powerful argument against the infection of man by the *B. abortus* of cattle is advanced by Edwards in the paper referred to. He says, ". . . there can be but little doubt that the two organisms (i.e., *M. melitensis* and *B. abortus*) differ in the all-important property of pathogenicity, for otherwise, in view of what we know concerning the excretion of the abortion bacillus in the milk, and the large percentage of cows that act as carriers of the bacillus, a large part of the population of Northern Europe and the United States would be liable to infection, but evidence to hand has failed to prove that the drinking of milk from aborted cows is a source of danger to human beings." On the other hand it has been stated that Malta fever does not originate north of latitude 46°, but cases have been observed in England by Manson himself. It has been pointed out that Switzerland and South Germany are the home of the milch goat. Nevertheless these countries are particularly free from Malta fever.

If *Bacillus abortus* even occasionally caused in man in other parts of the world where infection of cattle is common the remarkable symptoms manifested by patients from the Marandellas district and elsewhere in this country, the fact must surely have been noted; or if the symptoms of Malta fever were common in countries where the drinking of goat's milk could be excluded as a possible source of infection, but where infectious abortion was known to prevail, the circumstance would scarcely have been overlooked. It is certainly remarkable that although specific abortion of cattle has been prevalent in the Marandellas district since 1914, it is only within the last few months that the so-called Malta fever cases in man have been detected. The suspicion that abortion among human females might have been associated with the drinking of infected milk, however, has frequently been suspected and suggested.

It is also a fact worthy of consideration that on farms where men have been infected, the other members of the family have apparently escaped, although if infected milk is the cause of the disease one would have expected the women and children to have been the chief victims. In this connection it should be mentioned that the Malta fever organism is not a delicate organism and is very resistant to desiccation. It is, therefore, probably blown about in dust. Moreover, it is excreted in the urine of apparently healthy goats and cows. Possibly the *B. abortus* is disseminated in a similar manner, and if so, suspicion might fall upon the dust of cattle kraals where infected animals have

been herded, which would explain the large proportion of cases among males as compared with women and children.

Another statement made by Edwards may be quoted. He says:—

“Experimentally it has been found quite easy to infect and cause abortion among other farm animals and in small laboratory animals by causing them to be inoculated with or to ingest doses of Bang’s bacillus, and it is quite possible that even man may become infected; but the natural reservoir of the disease-producing organism is the cow, and there is every reason to believe that just as the bovine type of tubercle bacillus would cease to exist if bovine tuberculosis were completely eradicated, so would Bang’s bacillus no longer persist if the bovine species became extinct. In devising control measures, therefore, other animals than cows need not engage our attention.”

A grave responsibility is thus imposed upon my profession, and I may be forgiven if I give a brief outline of the measures which have been adopted by the Veterinary Department of this country in its endeavour to cope with a disease which up to the present has defied the efforts of administrations in other parts of the world.

At a meeting of the professional officers of the Veterinary Department, held in the Veterinary Laboratory, Salisbury, in August, 1920, to discuss this disease, it was decided:—

“That official quarantine of infected farms and herds was impracticable, and tended to defeat its own ends by leading to the suppression of information as to the existence of the disease. Similarly, the publication of notices on the doors of Magistrates’ Courts and in the *Government Gazette* was not desirable. It was admitted that the only method at present available to the Veterinary Department of limiting the distribution and dissemination of the disease was in the power of veterinary officers to refuse permits for the removal of infected or suspected cattle. It was decided that the best method of controlling the disease from the point of view of veterinary administration at the present time was to educate and assist the public, and it was suggested that veterinary officers should, when possible, deliver lectures on the subject in their respective districts. It was agreed that the best method of detecting or determining the specific nature of any outbreak of abortion was by Bevan’s modification of the pipette method of collecting blood for the agglutination test. The advisability of warning purchasers of cattle to buy subject to the test was discussed, but it was not considered feasible. It was decided, however, that veterinary officers should warn and give advice to buyers contemplating purchase of animals likely to be infected. It was agreed that the reports received from veterinary officers and stock owners as to the efficacy of the vaccine as prepared at the veterinary laboratory by the Bacteriologist were most satisfactory, and it was decided that the method should be

recommended and applied when possible, that is, when supplies were available. The danger of the bull as a source of infection was discussed, and it was decided that all bulls in infected herds should be tested, and if yielding a positive re-action to the agglutination test, should be destroyed, the test to be applied before vaccination. It was decided that non-reacting bulls should be removed from the herd for a period of six months, and should be vaccinated with the de-vitalised vaccine. It was decided that all female stock in an infected herd should be vaccinated with de-vitalised vaccine, including calves, and in this way an immune herd should be established. New stock should not be introduced to the herd until a normal calf-crop indicated the immunity of the herd, and then only after inoculation. It was agreed that so-called 'queen' cows were a source of danger and should be tested, and, if re-acting, should be destroyed. It was decided that vaccine should be issued through the District Veterinary Surgeons, in order that they might be aware of the existence of the disease in their districts, the first vaccination to be under the control of the veterinary officer in charge; but if necessary, subsequent injections to be performed by the owner. It was thought necessary to point out to owners that the vaccination could not restore life to a dead foetus, but might hasten the immunity of an animal which had aborted and prevent non-pregnant animals becoming infected. It was pointed out that a considerable number of barren cows failed to re-act, and that these could only be destroyed at the owner's discretion. The cause of their condition was probably other than infection by the *bacillus aborti*. It was decided that in all outbreaks an attempt should be made to trace the source and origin of the infection. It was considered desirable to apply the test when a number of cases of retention of after-birth was reported in a herd."

The special method of collecting blood for the agglutination test referred to is merely a modification of the Wright capsule, used with a certain preservative mixture which is added to the blood to prevent decomposition. Hitherto in this country and at the present time elsewhere, the technique of collection was crude and unsatisfactory. The animal was secured and generally thrown; a cord was passed round the base of the neck in order to "raise" the jugular vein, from which blood was drawn off into a sterile bottle. The operation had to be conducted under aseptic conditions, any extraneous organism making its way into the blood setting up changes which interfered with the accuracy of the test. The difficulties of successfully maintaining such conditions in veterinary practice may be readily understood by those having any field experience. The result was that at least 95 per cent. of specimens sent for test arrived in a putrid or hæmolyzed state and quite unsuitable for diagnosis. The pipette originally devised was merely a piece of glass tubing with a 4 mm. bore, and drawn out to a point at each end. The animal having been secured and its ear damped and dried, a bold

cut was made across the posterior auricular vein, so that the blood escaped freely. A small quantity of preservative having first been run into the pipette to about a quarter of its length, the point was applied to the blood accumulating at the wound, so that it was drawn into it by capillarity. The pipette was then sealed by sealing-wax or other adhesive material. By this method at least 95 per cent. of specimens submitted have arrived suitable for testing at the Laboratory, and it may be claimed that this simple invention has been the means of detecting the disease in many localities where otherwise it might have been overlooked.

After many experiments a still more simple method has been devised by means of which the veterinary officer, or indeed the farmer himself, will be able to test suspected animals without sending the material to the laboratory. The method may prove useful to medical practitioners, enabling them to carry out their own tests with *M. melitensis*, or indeed any micro-organism which will re-act to agglutinins.

Reference is also made to the de-vitalised vaccine prepared at this laboratory. The term "de-vitalised" has been coined to distinguish the vaccine from that which is generally referred to as a "dead" vaccine, in which the micro-organisms have been killed by heat.

Since 1914 Stockman has applied a vaccine to virgin and barren cows, consisting of enormous doses of living bacilli. This apparently strange procedure is based upon a well-known belief in other countries, that the majority of cows infected with infectious abortion do not abort at two successive pregnancies, or that if a cow aborts a second time, it rarely aborts a third.

It is also a well-known peculiarity in connection with infectious abortion in other countries that, provided infected animals are not introduced from without, the disease tends to wear itself out and in a few years to disappear from the herd. Also it is known that if a long interval, say four to six months, elapses between abortion and the next impregnation, the cow will carry her calf to full term. These observations suggested that in nature an immunity is sooner or later set up in a non-pregnant female at one time infected, and it was sought by means of the introduction of vaccines containing the living organism to imitate or hasten the natural process. The method, however, is fraught with danger, especially in this country, where it is often difficult to determine whether the cattle are in calf or not, and where primitive methods of transport render it unsafe to issue infective material.

A second method was tested, namely, the inoculation of cattle with vaccines made up of organisms destroyed by heat. Stockman, having drawn the deduction that the results did not justify the trouble involved, condemned the method, an example which has been followed by others, in spite of the fact that the conditions under which his tests were made were not free from objections. For example, the dead vaccine was inoculated into cows already pregnant, these cows being chosen from a badly infected herd, so that the foetus of some of them may have been seriously damaged before the vaccine was applied. German experimenters, Zwick, Zeller, Krage and Grunder, have also found that living vaccine yields the best results, but even with dead

vaccine figures show a well marked reduction in cases. There is, however, in my profession, as in others, a tendency to accept without criticism the voice of the oracles. One grave disadvantage attaches to the living vaccine, namely, that even when applied to non-pregnant animals the organism may become localised in the udder, from whence, when the animal becomes pregnant, it may infect the foetal membranes. These, being discharged when the calf is born, may set up infection in a clean herd, or re-infection in a herd from which the disease has died out.

Bevan has shown that the agglutination re-action produced by a heated "dead" vaccine, although not as strong as that produced by living vaccine, is nevertheless quite appreciable; and if agglutination may be taken as an index of the progress of immunity, the re-action set up should prove a valuable adjunct in dealing with this disease. But the heating of an organism to the temperature generally applied in producing a vaccine, coagulates the albumen of the organism and destroys its toxins. It also, as may be seen in the test tubes exhibited, renders the organism insusceptible to agglutinating sera, facts which may be seriously considered by the medical profession, who have to rely so often upon dead vaccines.

To overcome these objections Bevan devised a method of destroying the organisms employed in his vaccines, by exposure to chloroform, which although rendering the organism inert, does not destroy its toxins. A vaccine made in this way will still agglutinate, which cannot be said of many of the vaccines composed of organisms destroyed by heat.

Good results have followed the use of this vaccine when suitably applied, as shown by the reports received from District Veterinary Surgeons, but in some instances too much has been expected of it. In most cases where it has been pronounced a failure, careful investigation has shown that instructions were not carried out, or that many of the animals at the time of treatment were already well advanced in pregnancy, and probably infected, so that the expulsion of the calf was inevitable. In some cases also, the dose was too small to render the animal immune throughout the nine months of pregnancy, and in future the quantity of organisms to the dose will be greatly increased, and the timing of the injections will have to be altered, so that the immunity conveyed will be maintained throughout the full period of pregnancy. Apart from its intrinsic value, the vaccine is a useful adjunct to administrative measures. The knowledge that animals can be treated has prompted owners of infected herds to report, and has justified the Veterinary Department in refusing permits for the movement of such herds during the three months' period of treatment.

I think we may justly claim that the methods adopted by the Veterinary Department of this country in dealing with infectious abortion are far superior to any obtaining elsewhere. However imperfect they may be, an earnest endeavour has been made to cope with a disease which other administrations have admitted their inability to control, and have removed from the list of scheduled diseases—a lamentable confession of inertia and impotence.

CONCLUSIONS.

1. The disease known as infectious abortion of cattle which exists in Southern Rhodesia, is caused by the *Bacillus abortus* of Bang, and serological tests indicate that it is identical with the specific abortion of cattle in other parts of the world.

2. The *Bacillus abortus* of Bang bears a close morphological and biological resemblance to the *Micrococcus melitensis*. Serological tests also indicate a close affinity, in that certain strains of *M. melitensis* can be agglutinated with serum from cattle infected with infectious abortion, and strains of *B. abortus* can be agglutinated by serum from human patients suffering from undulant fever.

3. The characteristic symptom of undulant fever in goats and sheep is abortion.

4. Certain cases presenting symptoms resembling undulant fever have occurred in Southern Rhodesia in men who, as far as is known, have not obtained infection from goats, but have resided on farms where animals are or have been infected with infectious abortion.

5. It is suggested that these cases are suffering from an infection caused by the *Bacillus abortus* of cattle.

6. It is also suggested that human females may contract infectious abortion through the ingestion of the organism in milk and dairy products from infected cows.

7. Although infectious abortion is prevalent in other parts of the world where goat's milk is not used for human consumption, it has not been accused of causing the symptoms of undulant fever in man, nor has it been proved to cause abortion in human subjects.

8. Although infectious abortion has prevailed in the Marandellas district for many years, it is only within the last few months that cases resembling undulant fever in man have been recorded.

9. While circumstantial evidence points to the infection of man by the *Bacillus abortus* of Bang, and scientific tests up to a point support this suspicion, the final proof is not yet available.

10. If infectious abortion of cattle is essentially a bovine disease, a grave responsibility attaches to the Veterinary Department; and if this disease is communicable to man, a hearty co-operation between the medical and veterinary professions is necessary in dealing with it.

Arlington Sand Veld Experiment Station.

FIRST REPORT.

WINTER CROPS, 1921.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist, and
E. E. WRIGHT, Station Manager.

The need of a sand veld experiment station has for many years been acutely felt, and the want has recently been supplied through the generosity of Colonel Sir Harry Waechter, Bart., C.M.G., who not only provides the land on his Arlington Estate near Salisbury, but also defrays all the expenses of the station. The experiments are organised and controlled by the Department of Agriculture, but the farming community has Sir Harry Waechter to thank for the fact that the work herein reported on has been rendered possible.

For many years the Department has recommended the moisture-retaining vlei soils of the sand veld for the production of winter cereal crops, such as wheat, oats and rye, and for the growing of succulent feeds for dairy stock, sheep, etc. This is the first year, however, that it has been possible to carry out systematic experiments on this type of soil, and it will be generally admitted that the initial results are highly encouraging. The factor of primary importance with these soils is their ability to retain moisture during the dry season. Their fertility is recognised to be low, and this can only be improved by manuring, green manuring and by depasturing crops on the land. Their proper management is, therefore, intimately bound up in a system of mixed farming.

The soil placed at the disposal of the Department by Sir Harry Waechter is typical of thousands of acres of land in Southern Rhodesia, and almost every sand veld farm in the country includes a certain amount of it.

Operations were begun the first week of March of this year, the lands consisting entirely of vlei soil, which in the past had been cropped, but which had lain fallow for several years, and had largely reverted to weeds and grass. The degree to which the total acreage finally sown

to crop retained its moisture varied greatly. An unexpected and unusually heavy rain fell on 5th to 7th May, which rendered some acres of the more marshy land excessively wet and difficult to work, and also in some instances caused seed which had already been sown on low lying land to rot. Ploughing with a single furrow plough and eight oxen commenced on the 10th March. Plots numbered 1 to 7, 15 to 20 and 22 to 27 inclusive were once ploughed and once disc harrowed before being sown. Plots Nos. 8 to 14, 28 to 34 and 36 were first ploughed and disc harrowed, and about four weeks later were cross ploughed and disc harrowed again. Owing to the late date at which work was begun all preparatory cultivation had to be rushed and seed was put in immediately the land was sufficiently broken down to render drilling possible. This on an average was within four weeks of the date of the first ploughing. Under these circumstances only very moderate results could be hoped for, since the soil had very little time to become aerated or the grass roots to become rotted. Difficulty was also experienced in obtaining kraal manure, and in consequence only one quarter acre of land sown to cereal crops received such manure. Experience has shown that kraal manure assists both in sweetening these vleis soils and also in enriching them, and had more manure been available results would undoubtedly have been better. In almost all cases half of each plot was fertilised with a moderately heavy dressing of a standard complete artificial fertiliser. Several different brands of fertiliser were used, but in no instance did these dressings show profitable results, and it is evident that in the present state of the soil fertilisers cannot be regarded as a substitute for farmyard manure. As will be realised from dates given, many plots were seeded unduly late. The normal seeding time for cereals on such land is usually from 15th April to 15th May.

The total area of land which could be brought under crop was allotted as follows:—Wheat $12\frac{1}{4}$ acres, rye $9\frac{1}{2}$ acres, oats $8\frac{1}{2}$ acres, barley $3\frac{1}{2}$ acres, emmer 2 acres, linseed $1\frac{1}{2}$ acres, vetches 1 acre, Black-eyed Susan pea 1 acre, Yorkshire Hero pea $\frac{1}{4}$ acre, roots, rape, cabbage, etc., $1\frac{1}{2}$ acres.

WHEAT.

Plots 1 to 9 all received similar treatment. Preparatory cultivation consisted of one ploughing and two disc harrowings. Half of each plot received a dressing of complete artificials; the other half was untreated. Sixty pounds of seed was drilled per acre, and the land was then rolled and drag harrowed to break the surface crust. The plots were harrowed at the end of May and again the end of June.

Plot No. 1.—Seven acres Early Gluyas wheat, seed locally grown. Seed drilled 4th May. Germination was fair.

The soil consisted of a greyish black sand. There were a few excessively wet spots in the plot in which seed failed to germinate. Growth was fair, but crop stood poorly. On ant-heaps the stand was good, the plants stood better and the ears were larger. Soil retained its moisture well. The crop was in full ear middle of August. Average height 2 feet. The fertilised portion showed no improvement over the part untreated. Ripe 11th October. Reaped 22nd October. *Yield*

312 lbs. grain per acre. Considering the extreme rawness of the land the return may be considered very encouraging.

Plot No. 2.—Half acre Early Gluyas wheat, seed imported from the Union. Drilled 5th May. Soil similar to that of plot No. 1. Germination was good, but plants stooled poorly. The soil retained its moisture well. Crop was in full ear middle of August. Average height of straw 2 feet. Fertilised portion no better than that unfertilised. Reaped 9th October. *Yield* 532 lbs. grain per acre.

Plot No. 3.—Half acre Union No. 17 wheat, drilled 5th May. Soil same as on plot No. 1. Germination was good, but plants stooled poorly. At the lower end of the plot there was a large ant-heap, and on this the stand was excellent, with large well-filled ears. The soil retained its moisture well, except on the ant-heap, which became very dry. In full ear 27th July. Average height of straw 3 feet. No improvement on fertilised portion. Reaped 19th September. *Yield* 430 lbs. grain per acre. This variety proved earlier than was expected, and would have been better had it been sown later, as it was in full flower at the end of July, when frosts were still prevalent.

Plot No. 4.—Half acre American No. 8, drilled 9th May. Soil as for previous plots. Germination fair. Plants stooled poorly. In the middle of the plot the land dried out considerably. Ears began to show 4th August. In full ear 16th August. Average height of straw 3 feet. The fertilised portion showed no improvement over the part untreated. Ripe and reaped 10th October. *Yield* 360 lbs. grain per acre. The ears of this variety were very small and badly filled, and a number contained no grain.

Plot No. 5.—Half acre Lalkasar Wali wheat, drilled 9th May. The soil was more or less the same as that of the previous plots. Germination was good, but plants did not stool strongly. The soil retained its moisture moderately well. Ears began to show 27th July, and crop was in full ear middle of August. Average height of straw 2 feet. The fertilised portion showed no improvement over the part untreated. Reaped 6th October. *Yield* 540 lbs. grain per acre. This wheat did exceptionally well considering the rawness of the soil, and should do much better next year when the land is in more favourable condition.

Plot No. 6.—Half acre Australian Early; drilled 10th May. The soil of this plot was of a more sandy nature and poorer than the previous plots. Germination was good, but plants stooled weakly. The soil retained its moisture moderately well. Ears began to show 27th July. In full ear middle of August. Average height of straw 3 feet. The fertilised portion showed no improvement. Ripe and reaped 8th October. *Yield* 264 lbs. grain per acre. A number of the ears failed to set grain.

Plot No. 7.—Half acre Early Gluyas wheat; seed imported from the Union. Drilled 10th May. The soil was similar to that of plot No. 6. Germination was good and subsequent growth fair, but stooling was weak. The soil retained its moisture moderately well. Ears began to show 27th July, and plot was in full ear middle of August. Average height of straw 2 feet 6 inches. The fertilised portion showed no im-

provement on the part untreated. Ripe and reaped 29th August. *Yield* 440 lbs. grain per acre.

Plot No. 8.—Quarter acre Rooi Wol Koren; drilled 5th May. The soil was a poor greyish sand. Germination good, but stooled poorly. Subsequent growth only fair except on an ant-heap where the plants stooled well. The soil dried out somewhat, especially at the top end of the plot, where it became excessively dry, and where the ears failed to fill out. Ears began to show 27th July, and crop was in full ear middle of August. Average height of straw 2 feet. Fertiliser showed no improvement. Ripe and reaped 5th October. *Yield* 480 lbs. grain per acre. This wheat on the whole did well; and on the ant-heap was particularly good.

Plot No. 9.—Half acre Early Gluyas; seed imported from the Union. Drilled 10th May. Soil poor grey sand. Germination fair, subsequent growth fair, stooled poorly. The soil retained its moisture very poorly. Ears began to show 27th July. In full ear middle of August. Average height 2 feet. Fertiliser showed no improvement. Reaped 29th August. *Yield* 420 lbs. grain per acre. The soil was particularly poor, especially at the top end of the plot, where the wheat failed altogether.

Plots Nos. 15 and 19 were ploughed and disc harrowed and then cross ploughed and disc harrowed again about a month later.

Plot No. 15.—Half acre Lang Koren; seed Rhodesian grown. Drilled 17th May. Soil was a good moist black sand, and was not fertilised. Germination good. Subsequent growth good, and plants stooled fairly well. Soil retained its moisture well and remained in good condition throughout. Ears began to show 28th August. In full ear beginning September. Average height of straw 2 feet 6 inches. Ripe 31st October, reaped 7th November. *Yield* 100 lbs. grain per acre. This wheat, which is of the durum type, promised to give a bumper crop, but when threshed the ears were found to be very poorly filled, and many had no grain in them at all.

Plot No. 19.—Half acre Pusa No. 4 wheat; drilled 8th June. Soil same as above. Germination good, but stooled poorly. Subsequent growth fair. The soil retained its moisture moderately well. Ears began to show middle of August. Average height 2 feet. The fertilised portion showed no improvement over the part untreated. Ripe and reaped 12th October. *Yield* 320 lbs. grain per acre. This wheat is a quick maturing variety, but would probably have done better if planted earlier.

Plot No. 28.—Half acre Early Gluyas; drilled 23rd May. The soil was very poor and sandy. The plot was ploughed and disc harrowed during April, and about the middle of May was again cross ploughed and harrowed. Half the plot was manured with kraal manure at the rate of eight tons per acre and disced in. Half was untreated. Rolled and drag harrowed immediately after sowing and harrowed again end of June. Germination good, but plants stooled poorly and subsequent growth was poor. It was decidedly better, however, on manured por-



Wheat variety trials—Two rows of each variety. Arlington experiment station, 23rd June, 1921.



Durum wheat. Arlington experiment station, September, 1921.



Early Gluyas wheat. Arlington experiment station, September, 1921.



Kherson oats. Arlington experiment station, September, 1921.

tion. The soil failed to retain its moisture well and dried out much sooner than higher lying land adjacent. Ears began to show beginning of August. Crop in full ear middle of August. Average height of straw 2 feet. Ripe and reaped 12th October. Yield 300 lbs. of grain per acre. Growth on the part manured finally showed up to considerable advantage, and had the land been ploughed and manured earlier the yield would certainly have been much better. The crop did well to begin with, but towards the middle of August the soil dried out very much, and had the land not been manured the lack of moisture would have caused the yield to be even lower.

(To be concluded.)

The Cattle Industry.

By ERIC A. NOBBS, Ph.D., B.Sc.

The depression in the value of all forms of farm produce, which we hope is but transient, is affecting the cattle industry very seriously. At such a time the best quality suffers least, but medium and compounds or canners are almost unsaleable, and breeding stock, whether common or high class, has fallen sympathetically. The oversea market has always been regarded as a means of stabilising prices, but for the moment this also has collapsed. Our export to Johannesburg has dwindled to a fraction of what it was last year, and our marketable surplus of cattle is piling up, whilst some through age are now deteriorating.

In these circumstances the possibility of restarting the Odzi Canning Factory has again been raised, especially by the farmers in the eastern districts, and we understand that whilst the directors of the company are not prepared to do so, an option on the works has been given and negotiations are proceeding which may lead to a re-opening; or local effort may take it up. Any outlet such as this would be very welcome, especially as a South African demand has been created for the Odzi brand of canned meat, which proved itself of excellent quality and readily saleable. Although, no doubt, loss has resulted in the opera-

tions of the Rhodesia Meat Packing Co., Ltd., yet it has demonstrated beyond question that tinned beef can be made and sold. Experience has been gained, perhaps dearly, but it is none the less valuable and can in the future be turned to advantage. The idea of the proposition was fundamentally a sound one, and eventually the Odzi factory must play an important role in the disposal of our cattle, not only through canning, but also as a freezing works for export through Beira.

The Meat Producers' Exchange is less active in Southern Rhodesia than in the Union, since not unnaturally the organisation of sources of supply nearest to the main markets must receive first attention in the present early stages of the campaign. The latest phase, the virtual boycotting of supporters of the Exchange by its opponents, is an admission on the part of the latter that their objects and those of the Exchange are at variance; and since the Exchange has from its initiation sought to secure the interests of the prime producer and the ultimate consumer, it seems clear to which party public support is likely to be given. Important as is the success of this movement to the entire meat industry of South Africa, yet it must be recognised that distance alone cuts off the larger part of Rhodesia from access direct to the Rand for live cattle or to the coast between Capetown and Durban, and that other means of marketing our products must be sought. There is room and scope for operations in this direction by the Meat Producers' Exchange or some other body.

It is curious to find export of cattle from Southern Rhodesia to the Union used as an argument and grievance by the opponents of the Meat Producers' Exchange. No such criticism was raised before that body came into operation, when the traffic in cattle from Southern Rhodesia to the Union was three times as great as it now is. Apart from this, however, it should be observed by our breeders and dealers that our trade to the south commenced at a time when droughts and disease had depleted Union supplies, which have now happily been restored owing to recent good seasons, with the natural result that, independently of any other question, our cattle, which are the most remote, must be the first to drop out in favour of the local animal. No permanent market can be built up depending on the misfortunes of others, which, though recurrent, are fortunately for them not chronic. Southern Rhodesia must find its permanent markets elsewhere, and chiefly no doubt overseas.

Regulations were issued recently by the Government of Mozambique Company territory setting forth fresh conditions under which cattle could be introduced from Southern Rhodesia, and these were published in the *Agricultural Journal* for October. Considerable agitation has been caused to breeders on our eastern border by credible statements that these arrangements have been cancelled. Although no official communications have been received, it would appear that this traffic, so beneficial to both territories, is actually being interrupted. For the promotion of commerce, security is the first essential. No trading can be done if there is liable to be interruption at any time on short notice, or even without notice at all. It is unfortunate that our cattle, when proceeding to the low coastal veld, are liable to

contract the severe forms of red-water and gall-sickness existing there, and that is in itself a serious hindrance to trade without super-added restrictions. It is not as if our cattle introduced these diseases to the local stock; the converse is the case. We trust the fears which have been expressed as to interruption of trade are not warranted.

We notice that in parts of the Union there is an outcry against railway rates for the conveyance of cattle, and it has been publicly stated that the prohibitive rates prevented farmers from using the railway for this purpose, and that driving was being resorted to in place of trucking, which had hitherto been the general practice. The same facts hold good in Rhodesia, and with more reason in view of the higher rates, the lower value of stock and the greater possibilities for trekking through sparsely occupied or quite vacant land.

All interested in the future of the cattle industry in South Africa should read a report issued by the Department of Agriculture of the Union (Bulletin No. 3, 1921, price 3d.), containing information collected by Mr. James Chalmers, M.R.C.V.S., in regard to handling, preparing and particularly the inspection of meat exported from South America. To obtain these particulars, Mr. Chalmers visited the Argentine, Uruguay and the London storages and distributing agencies at Smithfield and elsewhere.

The facts gleaned and observations made are of the greatest value. The work has been most ably done and lucidly recorded; it remains for breeders, the exporters and distributors and the Governments concerned to apply these lessons to practice. It is no use for the farmer to produce high-class cattle if, as is to so great an extent the case to-day, the carcasses are badly prepared; nor is this of much avail if Government inspection is imperfect; whilst even if in all these respects no fault could be found, there remains room for useful work on the part of the agents employed to receive and distribute the meat on the other side.

On these points the following brief extracts from Mr. Chalmers's interesting report are deserving of special attention, though such quotations must obviously lose much when removed from the context. As to the breeder's share in the process, he writes: "There is no argument permissible in the statement that the breeder and producer constitute the greatest essential in the export of meat. If the farmer does not lay the foundation thoroughly, it is impossible for the other factors to produce the required product. He must give special attention to selection, breeding, feeding and early maturity." . . . "It is useless to breed from any but the best types of animals for food purposes, whether beef, mutton or pork. All of these carcasses should be small, plump, young, full of meat, small of bone and not fat in lumps, but with the fat distributed evenly over the surface as well as between the muscles or flesh." It should be noted that the heavy carcass so often praised in South Africa is not desired.

In regard to the exporter's part, the report states: "Here again many faults which at present are not receiving attention have to be

remedied. I consider the exporters are entirely to blame for the bad name which has been given to South African meat. The slaughtering, butchering, preparation and grading have all been carried out in a slipshod, slovenly manner." As to the duty of the Government, Mr. Chalmers very rightly says: "I am of opinion the Government should step in and take a firm stand in connection with what is being exported so as to compel shippers to establish a reputation for the country's meat." The last link in the chain is the receiving agent, in regard to whom Mr. Chalmers writes: "I think it would be beneficial if exporters would send consignments to more than one agent at the markets so as to promote competition."

The bulk of the report is taken up with an account of the process of killing, preparing meat and the many by-products in the great "frigorificas" of South America, and with details of the system of veterinary inspection during these processes and of the procedure in issuing certificates and in condemning diseased organs or flesh.

Space will not permit of detailing all the facts recorded and recommendations made, for which those interested must be referred to the report itself, but a few more quotations may be allowed to indicate the general conclusions arrived at.

"I know of no reason why the Union of South Africa should not become an exporting country and assume her correct position amongst the foremost of the countries to-day which are reaping a rich harvest from this industry by the application of thought, system, Government supervision and the investment of private capital, resulting in internal prosperity, contentment and development."

To one remark that the "natural grazing of the Argentine is much better than our veld" some exception must be taken. This is not so, and probably if Mr. Chalmers had had fuller opportunities and more time to visit the "camp" and the "estancias" he would not have said so. No doubt there is excellent natural pasture in parts of the Argentine, notably round Buenos Aires, and of course there are large tracts of inferior grazing in South Africa, but generally speaking our veld is better than theirs in respect of natural pasture. Certainly this is very much the case in comparison with Southern Rhodesia. Where the Argentine far outclasses South Africa, however, is in the capacity for improvement of this natural pasture and conversion of rather poor grass country like the Pampas into wonderful lucerne lands without great labour in clearing, cultivating or irrigation, and over thousands of square miles of country.

Mr. Chalmers himself quotes from *The Meat Trades Journal and Cattle Salesmen's Gazette* of 20th January, 1921, from which we take the following passage describing the beef import trade of Great Britain in 1920, as it is illuminating in regard to the present position:—

"The imports of beef were the heaviest on record, the arrivals of fresh, chilled and frozen reaching the huge total of 9,861,837 cwt., an increase of more than $3\frac{1}{4}$ million cwt. over those of 1919, and of 600,000 cwt. over 1913, which previously held the record. Of the

supply, 10 per cent. was chilled, which, while a great advance on 1919, is still very far short of pre-war days, when about 60 per cent. of the consignments reached us in this popular form. It is, of course, the more expensive method of carrying meat, and until maximum prices are removed we will have to be content with the bulk of our beef coming hard. Argentine was, as usual, our principal source of supply, with $6\frac{1}{4}$ million cwt. or 66 per cent., New Zealand coming second with 9 per cent. and Australia next with 8 per cent. The consignments of chilled and frozen beef from Uruguay represented about 8 per cent., other countries (Brazil and South Africa) 6 per cent. and the United States 2 per cent. Denmark and Holland also gave us a few parcels of fresh killed beef, but they were as 'drops in the ocean.' It is interesting to note that the import of tinned, canned and extracts of beef, including tongues, fell from $2\frac{1}{2}$ million cwt. in 1919 to 760,930 cwt. last year. The latter figure is still, however, 100,000 cwt. greater than the 1913 returns."

In concluding his report, Mr. Chalmers alludes to this same point when he says: "The present position of the world regarding the available supply of meat and its products gives South Africa an excellent opportunity of establishing herself as an exporting country. There is no doubt a tendency at present for human beings to consume more meat than they have previously done, and this appetite will increase. Again, on account of the great war, Central Europe has been denuded of its stock. Any increase that may take place must go to re-stocking, but in the meantime the inhabitants must be fed, providing another outlet for those countries that can supply. There is a serious decrease of stock in the Argentine, and it will be necessary for that Republic, which to-day supplies the greatest quantity of export meat, to pause and take stock of her resources. Even in the United States of America, at one time the 'home' of export, the supply cannot equal the demand to-day, and they are importing meat from the Argentine."

The lessons of this most instructive report intended primarily for the Union of South Africa are applicable in every particular also to Southern Rhodesia, and the writer by his comprehensive investigations and frank statements has conferred a service to the stock farmers of the entire South African sub-continent.

Annual Report of Experiments, 1920-21, Experiment Station, Salisbury.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist.

The season on the whole was favourable, and though several spells of drought occurred which seemed likely to reduce the yields, crop returns were on the whole equal to any previously recorded for the station. The rainfall was as follows:—

October	.38 inch.
November	2.01 inches.
December	6.66 inches.
January	4.87 inches.
February	9.24 inches.
March	6.57 inches.
April	.73 inch.
May	3.00 inches.
Total ...	33.4 inches.

In reading the following report, farmers may be disposed to criticise the exceptionally high yields of maize obtained on most of the plots. It is a noticeable feature, however, that returns from other crops are not in proportion so unusually high. The land is ploughed only once with a mouldboard plough, but this ploughing is done directly crops can be reaped or maize can be stooked and carried. After ploughing it is harrowed and clod crushed as thoroughly as possible. All maize is hand planted and is cultivated five times—three times horse hoed and twice hand hoed. Weeds have largely been eliminated and make little demand on the soil, but on the other hand, although all ground is regularly rotated with legumes, very little manure or artificial fertilisers have been applied (except on plots where expressly stated) since the station was opened in 1909. The general high standard of the maize yield can therefore be attributed to early ploughing, thorough preparation and subsequent cultivation of the land, and above all to obtaining *by hand planting as near a hundred per cent. stand as possible.*

The fact that the yields are higher than those ordinarily obtained on most farms in no way detracts from the practical application of the experiments, since each individual return must be compared with other yields obtained in the same *series*. Thus although on land con-

tinuously cropped to maize for eight years and without any manurial treatment, a yield of 13 bags per acre over any large acreage would be phenomenal, yet the increase brought about by better methods of farming as exemplified in the three and four course rotations is proportionately large and clearly proves the value of these systems.

The annual report of experiments for the year 1919-20 was published in the *Rhodesia Agricultural Journal* of February, 1921, and has been reprinted as Bulletin No. 382. A report of the rotation experiments covering the years 1913-1919 was published in the issue of the *Journal* for December, 1919.

EXPERIMENTS WITH MAIZE.

Rotation Experiments.—Maize planted 24th November. Variety, Salisbury White. Misses filled in 11th January. Three times horse hoed and twice hand hoed.

System of cropping.	1920-21 yield per acre.	Average yield for previous years.	Total number of bags produced by
1. Maize continuous, 8th year	13 bags ...	6 years : 7.06 bags	7 crops : 55.42 bags
2. Alternate maize and bare summer fallow	21½ bags	5 years : 12.3 bags	6 crops : 83 bags
<i>Three course rotation—</i>			
3. Maize	21½ bags	5 years : 13 bags...	6 crops : 86½ bags
*4. Velvet beans	1 ton hay	1 ton hay	6 tons hay
5. Wheat	180 lbs. ...	2.7 bags	14.4 bags
<i>Four course rotation—</i>			
6. Maize	35 bags ...	4 years : 15.5 bags	5 crops : 97 bags
7. Wheat	2.4 bags...	2.24 bags	11.36 bags
*8. Velvet beans	1 ton hay	1 ton hay	5 tons hay
†9. Mangels (— 6 tons dung per acre)	5 tons ...	3 years : 10 tons ...	4 crops : 35 tons

*Actual weights of velvet bean hay are not taken every year, but the crop is estimated, and as a check is weighed periodically.

†In 1919-20 the mangel crop failed, and late planted potatoes were put in instead. This crop apparently took very little out of the soil. In the present season the first mangel sowing failed, the second was taken by cut-worm, and not until the third sowing on 10th February was a stand obtained.

The benefit of rotation is very clearly demonstrated in these results. The consistency with which the relative differences in yield, from the different systems of cropping, have been maintained ever since the trials were commenced is remarkable.

Second Series Rotation, Commenced 1919-1920.—Treatment as in first series. These rotations are intended to apply in a practical manner the lessons learnt from the first series commenced in 1913-14 and in which mangels and summer wheat figure. The former cannot be utilised at present on a large scale, and summer wheat is as yet

too unreliable a crop. From this second series of rotations any farmer should be able to construct a rotation system suited to his own particular conditions and requirements.

System of cropping.	Yield, 1919-20.	Yield, 1920-21.
1. Maize continuous; no manure	25 5 bags	27.2 bags
<i>Four course rotation—</i> Land receives yard manure once every four years, and during same period one fine-strawed crop is grown and the stubble ploughed under.		
2. Maize; 8 tons dung per acre applied in 1919-20	26 bags	28 bags
3. Maize; 8 tons dung per acre applied in 1920-21	23.7 bags	26.9 bags
4. Sudan grass 1919-20, maize 1920-21	$\frac{1}{2}$ ton hay per acre	28.55 bags
5. Maize 1919-20, Sudan grass 1920-21	24.6 bags	3,030 lbs. hay
6. Maize continuous; no manure	23.3 bags	24.2 bags
<i>Four course rotation—</i> Land receives 150 lbs. complete artificials per acre once every four years, and once every four years is green manured with velvet beans.		
7. Maize + fertiliser applied in 1919-20	23.1 bags	25.9 bags
8. Maize + fertiliser in 1920-21	23 bags	24.6 bags
9. Velvet beans ploughed under 1919-20, maize 1920-21	...	28.7 bags
10. Maize 1919-20, velvet beans ploughed under 1920-21	19.2 bags	...

It will be observed that in all cases the yields this season are higher than those of the previous years. The heaviest yield of any is after velvet beans ploughed under, while next in order come maize after the stubble of Sudan grass ploughed in and the maize after maize manured with dung the previous year. So far the results would seem to indicate that the soil's need is organic matter and nitrogen rather than mineral plant food. It will also be observed that in 1919-20 there was a very marked falling off in yield as between plots 1, 2 and 5, and plots 7, 8 and 9, i.e., from east to west of the land. There is no reason to think that had maize been grown on plot 9 in 1919-20 the yield would have been any better than on plots 8 or 10, yet, after being green manured with velvet beans that season, this plot has this year given the heaviest yield of any.

Maize following certain other crops.—Following on trials dealt with in last year's report, further experiments were commenced with a view to studying the effect of other previous crops on maize. Maize

planted 13th December. In other respects treatment was similar to that for rotation plots.

Maize after lupins	17 $\frac{1}{4}$ bags per acre.
Maize after Hibiscus	17 $\frac{1}{4}$ " "
Maize after Sunn hemp	21 " "
Maize after peas	22 $\frac{1}{2}$ " "

Maize and Sunflower rotation.—Planted 18th December. The object of this trial is to ascertain whether, as is frequently reported, sunflower is really a useful change crop with maize. One plot grows maize every year and two others are annually rotated with maize and sunflower. The test commenced in 1919-20.

Maize after maize	23 bags per acre.
Maize alternating with sunflower	22 $\frac{1}{4}$ " "

If this trial does nothing else, it at least seems to indicate that in Rhodesia sunflower is not a particularly exhausting crop.

Green manuring versus ploughing in of stubble only.—The object of these trials is self-explanatory.

System of cropping.	Sown.	Yield in bags per acre.
1. Maize after Niger oil ploughed under ...	12th December	23.75
2. Maize after stubble of Niger oil ploughed under	12th December	25.25
3. Duplicate of 1	23rd November	16.75
4. Duplicate of 2	23rd November	16.6
5. Maize after velvet beans ploughed under ...	12th December	26.5
6. Maize after stubble of velvet beans ploughed under	12th December	26.75
7. Maize after Sunn hemp ploughed under ...	23rd November	18.75
8. Maize after stubble of Sunn hemp ploughed under	23rd November	23.0

Plots 1, 2, 5 and 6 were adjoining and as far as could be judged were alike in fertility. The value of velvet bean as a previous crop to maize again stands out clearly. Plots 3, 4, 7 and 8 were also adjoining, but were not so uniform in fertility. The advantage of a legume as against Niger oil, a non-legume, is, however, well marked. The results would seem to indicate that in decomposition Sunn hemp and Niger oil have a temporary toxic effect on the soil which is not found in the decomposition of velvet beans. Maize is again being grown on these plots in 1921-22, and the comparative results in the second season after green manuring promise to be of great interest.

Summary of Results in Green Manuring Experiments.

	Bags per acre.
Average yield of maize on three plots green manured previous year with velvet beans	25.5
Average yield of maize on three adjoining plots green manured with velvet beans which had received 1,500 lbs. lime per acre	25.5
Average yield of maize over all plots green manured with velvet beans previous year	26.4
Average yield of maize on ten untreated plots not green manured previous year	20.9

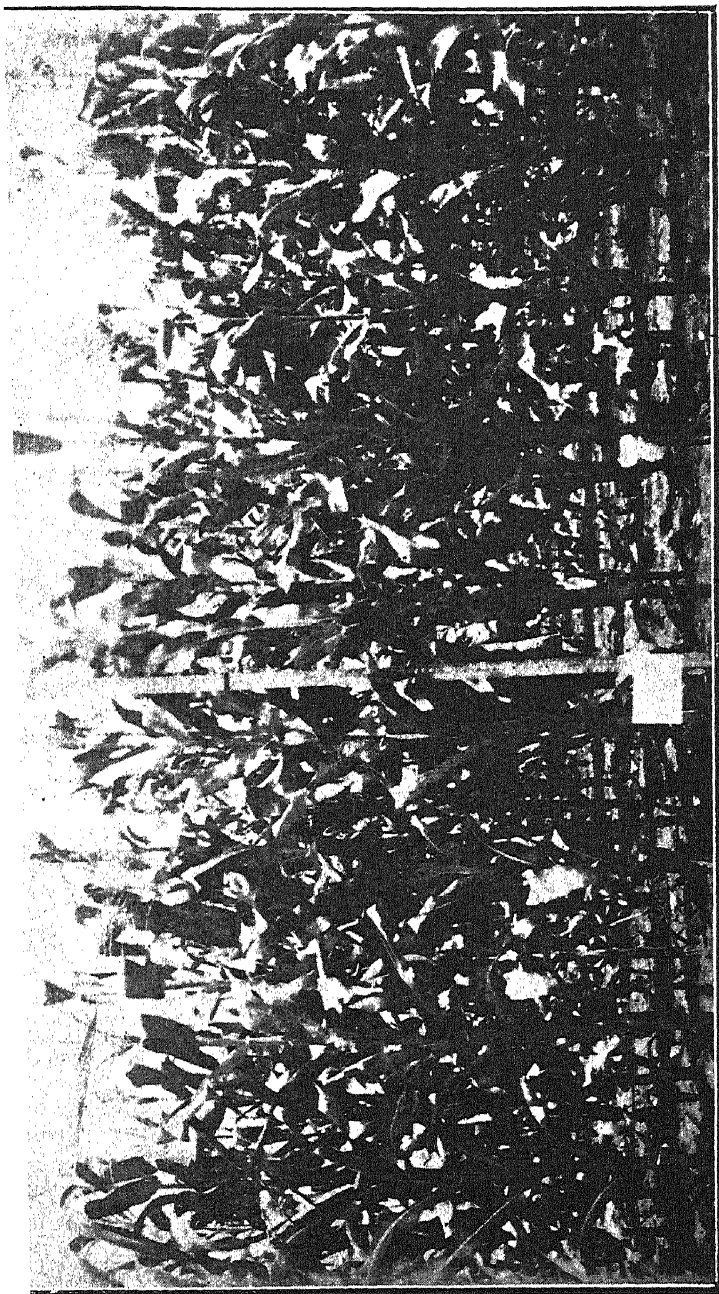
Percentage of maize plants in stand.—This experiment was commenced in 1919-20 in order to demonstrate the importance of obtaining better stands in our maize fields than are at present usually found. On certain plots as near a perfect stand as possible is obtained by planting very thickly and then thinning out. On the other plots the perfect stand is similarly secured and a known percentage of plants is then removed from each. The plots were sown thickly on 21st December and received the usual number of cultivations. Thinning to obtain the perfect stand was done on 4th January and the known percentage of plants was removed on the 20th January. When thinned, the plants in the perfect stand stood 40 x 15 inches apart. The results were as follows:—

Plots Nos. 1 and 2—	1920-21.
Perfect stand	18.9 bags per acre.
Perfect stand less 10 per cent. of plants removed	16.9 " "
Plots Nos. 3 and 4—	
Perfect stand	25.2 " "
Perfect stand less 25 per cent. of plants removed	18.3 " "

The two areas of land selected for these plots proved not to be very uniform, and the vigour of growth on plots 1 and 2 was inferior to that on plots 3 and 4. This accounts for the much heavier yield from the perfect stand on plot 3 than from that on plot 1. Had the 25 per cent. of plants not been removed from plot 4 it is safe to assume that its yield would have equalled that of the perfect stand on plot 3. The removal of 25 per cent. of plants still leaves 75 per cent. to bear ears, and when it is realised that the average farm stand only contains 60 to 70 per cent. of plants, of which some will certainly be barren, it is easy to see where a great leakage in yield and wastage in cost of production occurs. Imperfect stands are often due to imperfectly prepared lands resulting from neglect of early ploughing.

ADDITIONAL EXPERIMENTS WITH MAIZE.

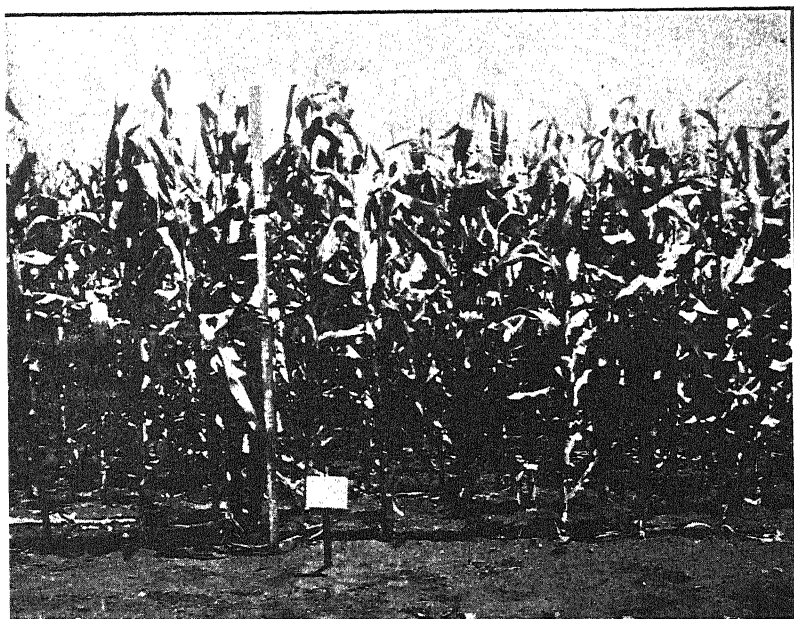
Date of Planting Trials.—This experiment comprised six plots sown at various dates from the 28th December, 1920, to 23rd January, 1921. The variety used was Salisbury White. The following table shows the



Maize after velvet beans ploughed under previous season ; yield $25\frac{1}{2}$ bags per acre. Experiment station, Salisbury.



Rotation trials—continuous maize, eighth year without manure or fertiliser.
Experiment station, Salisbury.



Maize in four-course rotation—mangels, wheat, velvet beans, maize; maize
yield 1921, 35 bags per acre. Experiment station, Salisbury.

results. It will be noticed the heaviest yield resulted from the earliest planting. This confirms many previous trials.

Date sown.	Yield of grain per acre.
28th December, 1920	3,840 lbs.
5th January, 1921	2,200 lbs.
11th " "	930 lbs.
15th " "	900 lbs.
19th " "	490 lbs.
23rd " "	370 lbs.

Distance Planting Trials.—The effect the distance between plants has, not only on the yield of grain and fodder, but also on the height and size of stalk, is of interest. It was noticeable that when the plants were crowded the stalks were thinner and produced better quality fodder, but the ears were fewer and much smaller. The wider spacing of planting caused a stronger growth of stalk. The heaviest yield of grain was obtained from rows 40 inches apart with plants 15 inches apart in the rows, which is more or less the generally accepted planting distance. The soil was only of moderate fertility. The results in detail were as follows:—

Distance of rows apart.	Distance of plants apart in row.	Yield of grain per acre.
40 inches	6 inches	1,800 lbs.
" "	9 "	2,130 "
" "	12 "	2,240 "
" "	15 "	2,820 "
" "	18 "	2,390 "
" "	24 "	1,840 "

With a view to ascertaining the effect of distance of planting on yield of fodder for silage, half of each plot was cut for this purpose. The results are most instructive and tend to show that the normal planting for grain is also approximately the best for silage purposes. Such a planting has the additional advantage of securing a maximum development of cob and thus ensuring a higher feeding value than when the stalk is fed alone or with few badly developed ears. The exceptionally heavy yield of 16 tons of fodder may call for comment. This is largely due to great care being exercised to secure a full stand of plants. The effect of similar treatment on grain yields has already been referred to.

Distance of planting.	Weight per acre of green fodder.
40" by 6"	28,800 lbs. per acre
40" by 9"	29,400 " "
40" by 12"	28,700 " "
40" by 15"	32,000 " "
40" by 18"	32,040 " "
40" by 24"	23,930 " "

Maize Variety Trials (Early, Medium and Late Varieties).—It should be noted that the first two varieties are small round-grained flints. Their only merit is their earliness in ripening. The results show that the late dent varieties give the heavier yields.

Variety.	Ripening period.	Average yield per acre over two years, 1919 and 1920 seasons.
Early Flint	110 days	6.17 bags
Cango (Flint)	120 "	7.35 "
Hickory King (Dent) ...	150 "	14.9 "
Potchefstroom Pearl (Dent)	150 "	17.1 "
Salisbury White	150 "	17.5 "

Effect of Topping Maize Plant.—This experiment has now been conducted for two seasons to test the effect of topping maize plants before tasselling, the object being to ascertain whether this could be practised on plants affected by stalk-borer, the tops afterwards being fed or burnt. The results are as follows:—

Date sown	Date topped.	Height of plant after topping.	Yield of grain per acre.
20th December	15th February	12 inches	750 lbs.
" "	" "	18 "	1,500 "
" "	Not topped ...	Normal growth ...	3,250 "

These results confirm those of last season. The treatment suggested in the case of stalk-borer attack is no doubt drastic, but although the yield in grain from plants treated as above is very considerably reduced, it has the advantage of combatting a pest which would otherwise probably destroy the plant. Topping and burning or feeding the tops will also assist in keeping the borer under control.

High versus Low Veld Seed.—A question of great importance to growers of seed and commercial maize is the effects of previous environment upon the value of the seed. One aspect of this is, will seed grown at a low altitude be any more or less productive when transferred to the high veld than seed produced at a high altitude and *vice versa*?

Variety.	Source of seed.	Altitude.	Yield of grain per acre.
Hickory King ...	Experiment Station, Salisbury	4,825 feet	3,910 lbs.
" ...	G. Rattray, Bindura	3,737 "	3,840 "

This experiment must be continued for several more seasons before definite conclusions can be come to.

Growers' Tests (Salisbury White).—Continuation of trials commenced previous year:—

Source of seed.	Yield of grain per acre, 1920.	Previous crop.	Yield of grain per acre, 1919.
Experiment Station ...	4,420 lbs.	Cotton	2,480 lbs.
F. C. Peek	4,070 "	"	2,200 "
D. Black	4,530 "	"	2,220 "
C. C. Townsend	3,880 "	"	2,560 "
E. J. F. Smith	3,450 "	"	2,660 "

This experiment is obviously inconclusive. It was initiated in order to test the extent to which different growers had succeeded in fixing the type of Salisbury White. Last year station grown seed headed the list with 75 per cent. of 12-row ears. Unfortunately this year, owing to an oversight, this feature was not recorded. The test will be continued.

Seed from Ears with Short Sheaths (tips of ears exposed) versus Long Sheaths (ears well covered)—Variety Salisbury White.—This experiment has been undertaken to determine what effect the continued use of seed from ears having the tip of the cob more or less exposed may have. The first season's results show no serious tendency for the percentage of ears with exposed tips to increase.

Number of plants raised from seed from ears with short sheaths.	Produced.	Percentage.
354	276 ears with long sheaths ... 78 ears with short sheaths ...	78 per cent. 22 „
Number of plants raised from seed from ears with long sheaths.		
353	338 ears with long sheaths ... 15 ears with short sheaths ...	96 „ 4 „

The experiment indicates that the difficulty of exposed tips can, to a great extent, be overcome by selection.

Seed from Long versus Short Ears.—This experiment with Salisbury White was commenced during the season under review. The standard length of a Salisbury White ear is 9 to 9½ inches.

Length of short ears=8 inches ...	Number of plants grown from short ears=387	387 plants produced— 342 ears under 9 inches long, i.e., 88 per cent.; 45 ears over 9 inches long, i.e., 12 per cent.
Length of long ears=9 inches and over	Number of plants grown from long ears=377	377 plants produced— 260 ears under 9 inches long, i.e., 69 per cent.; 117 ears over 9 inches long, i.e., 31 per cent.

Double Cropping with Maize and Velvet Beans both for Grain.—An extremely interesting trial was conducted (for the first time on a large scale) to determine the feasibility of growing maize and velvet beans together on the same ground and both for grain production. The beneficial effect on maize of contiguous legumes has already been ascertained, and it only remained to ascertain to what extent the principle could be put into practice. Two separate trials were made; in both maize was planted in rows 40 by 30 inches apart, and the beans were sown in the

same row and between the maize plants. In the first trial the beans were sown the same date as the maize, and in the second a month later than the maize. The result this season shows that if both crops are to be grown for "grain" the planting of the beans cannot be delayed long after that of the maize, and that planting both on the same date is quite satisfactory. Further trials will be conducted, but it may be stated that the maize, being sown in these tests at only half the usual rate of seeding, was far thinner than was necessary. The yields were as follows:—

1. Maize and beans sown 25.11.20, after buckwheat; maize 14.3 bags per acre; velvet beans 2.9 bags per acre.
2. Maize sown 25.11.20, velvet beans 25.12.20, after legumes; maize 17.1 bags per acre; velvet beans failed to mature seed.

Further trials will be necessary to demonstrate whether the reduced yield of maize, when both crops are sown the same date, is to be attributed to the smothering effect of the velvet beans.

[*Note.*—The rest of this report, dealing with crops other than maize, will appear in our February issue, and will later be reprinted in bulletin form.—Editor.]

White and Yellow Maize.

A COMPARISON.

By C. MAINWARING, Agriculturist.

Rhodesia has for some years determined to produce only one class of maize for export, namely, "Flat White." This is a unique position, which no other maize producing country can claim. The choice was made because this type is the most profitable to grow and not through any mere conservatism or lack of enterprise. Our climatic conditions afford special incentive to the production of the particular varieties which we are growing. The Rhodesian farmer until now has been satisfied and has felt no need for other varieties, but instead has continued improving those he possessed. He considers there would be no

advantage in changing his pure white breeds which are already growing and yielding so well. Even new settlers also have been content to follow the lead of the older growers and to plant the varieties which have adapted themselves to local growing conditions. At the present time, however, the question is being asked, "Have we not made a mistake in sticking to only one breed?" Argentine yellows are fetching to-day on the British markets 1s. to 1s. 6d. per bag more than our pure-bred flat whites, and 90 per cent. of the maize exported from the Argentine to Europe consists of the small yellow flint.

Now, although flint maize appears to have been grown in South Africa long before the introduction of the dent breeds, it has never become popular on account of its low yields, and is now only cultivated by natives or in districts of light rainfall and affected by drought. Dent breeds of maize are without exception better yielders than flint. Therefore, so far as the grower is concerned, he must consider what class of maize he can produce most profitably in the particular area in which he is situated, while at the same time keeping before him the market prices of the different types. He has to consider whether he can produce the one which commands the highest export price, or must he grow the one fetching the lower price, but giving a better acre yield. In this connection we in Rhodesia must also consider our long growing season, insect pests and diseases.

Breed tests conducted on the Government experiment station, Salisbury, during the season 1920-1921 gave, in round numbers, the following results:—

Varieties.	1920.	1921.
Cango (flint)	7 bags	7 bags per acre
Flint	4 "	7 " "
White Botman (flint)		12 " "
Salisbury White (dent) ...	14 "	21 " "
Hickory King (dent)	10 "	20 " "
Potchefstroom Pearl (dent)	12 "	21 " "

These results clearly indicate that it would not be profitable to grow the flint varieties, even though they are at the present time fetching a shilling to eighteenpence more per bag than is offered for either white or yellow dents on the English market. The greater yield per acre of our standard varieties as compared with the flints, even at a lower selling price, will more than compensate for the premium price which yellow flints secure.

Rhodesian growers of maize, by confining themselves to one class of maize, have escaped what is now considered a serious menace in the Union. The Government graders there complain of the difficulty of finding No. 1 grade amongst the grain offered for export, owing to the growing of so large a number of varieties and the cross fertilisation that has taken place between the yellow breeds and the whites. This means a big increase in the number of third grade and rejects.

Although numerous breeds have been introduced into the Union in order to improve the yield per acre, and to meet the demand of the export trade, the average yield over the whole of the Union is stated

to be still only just over three bags per acre. Rhodesia's average for 1920 was well over six bags per acre. To one who has watched the development of the numerous new breeds introduced into the Union of South Africa it is evident that the average life of any of the varieties either white or yellow is a matter of a few years only. This period of life is determined by two factors: (a) the length of time required to demonstrate its suitability or otherwise to climatic and soil conditions, (b) the period which elapses before it becomes so impure that its characteristic advantages are no longer apparent. This loss of purity as mentioned above is proceeding rapidly, and is already causing alarm amongst growers and exporters of maize.

It is true that new varieties are discovered sometimes which show improved qualities over the older ones, which have been allowed to decline through carelessness in selection of seed. But these new varieties in their turn, for the want of proper control, proceed to deteriorate in the same manner as soon as their cultivation becomes extensive. The purification and careful selection of existing Rhodesian varieties is continually being advocated by the Agricultural Department, and at the present time satisfactory and apparently pure breeding strains have been obtained of each of our most profitable and commercial varieties.

The reason that Rhodesian varieties have retained so well their character and purity is due to the fact that they have not been brought into contact with numerous other breeds of maize, especially yellows, the colour of which is dominant over white.

Yellow dents such as Golden Eagle—an old Rhodesian variety now discarded—gave equally as good a yield per acre as the white dents, but similar varieties grown in the Union to-day command no more per bag on the English market than the white varieties we are at present growing. In order to show that the yellow breeds, either dent or flint, have not gained in popularity during the past eleven years, I reproduce the following prize lists of breeds of maize in competition at the Witwatersrand shows in 1910 and 1921, also the varieties exhibited at Salisbury in the same years:—

Varieties of Maize Exhibited at Johannesburg Show, 1910.

White Varieties (17).—Hickory King, Louisiana Hickory, Hickory Horse Tooth, Salisbury White (Rhodesia), Iowa Silver Mine, Champion White Pearl, Virginian Horse Tooth, Ladysmith White, Natal White Horse Tooth, Boone County, Woods Northern Dent, Wisconsin White Dent, White Bread Mealie, Brazilian Flour Corn, Thoroughbred White Flint, White Botman (flint), White Cango (flint).

Yellow Varieties (10).—Eureka, Yellow Hogan, Chester County, Natal Yellow Horse Tooth, German Yellow, Leaminy, 100-day Bristol, Yellow Cango (flint), New England 8-row (flint), Gillespie's Yellow (flint).

Varieties of Maize Exhibited at Johannesburg Show, 1921.

White Varieties (10).—Hickory King, Louisiana Hickory, Texas Hickory (Hickory Horse Tooth), Salisbury White, Potchefstroom Pearl,

Iowa Silver Mine, Ladysmith White, Natal White Horse Tooth, White Botman (flint), White Cango (flint).

Yellow Varieties (6).—Reid's Yellow Dent, Chester County, Golden Beauty, Natal Yellow Horse Tooth, Yellow Cango (flint), Yellow Flint.

Total number of varieties shown, 1910—27.

Total number of varieties shown, 1921—16.

Varieties of Maize Exhibited at Salisbury Show, 1910.

White Varieties (4).—Boone County, Salisbury White, Hickory King, Hickory King 10-row (Louisiana).

Yellow Variety (1).—Golden Eagle.

Varieties of Maize Exhibited at Salisbury Show, 1921.

White Varieties (5).—Hickory King, Louisiana Hickory, Texas Hickory, Salisbury White, Potchefstroom Pearl.

Yellow Varieties (Nil).

Total number of varieties exhibited, 1910—5.

Total number of varieties exhibited, 1921—5.

Maize Awards at the Rand Show.

We regret that the following list of awards gained by Mr. H. Knieser of Nyapi farm, Eldorado, was omitted from the notice which appeared in our October issue:—1st and champion, 500 ears Hickory King; 1st, ten ears Hickory King, and 2nd reserve champion; 1st, ten ears Louisiana; 3rd, ten ears Salisbury White (Texas Hickory)—all low veld.

Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm.

By H. G. MUNDY, F.L.S., Chief Agriculturist and Botanist, and
J. H. HAMPTON, Farm Manager.

The following report on yields of crops grown last season on the Gwebi experiment farm is published for general information, and will, it is thought, be read with special interest by those farmers who visited the farm and inspected the growing crops. In all, some 500 acres were under cultivation, and of this area, rather more than half was planted to maize for grain or silage.

The most important experiments in progress are the rotation trials, which occupy 126 acres, and of which in 1920 one half were planted to maize. Each plot is three acres in area, and there are being tested in all 13 combinations of cropping. With three exceptions, the whole rotation is represented on the land each year. The land allotted to these experiments is very uniform, the southern half of each plot being a good red loam. On the northern half of each the subsoil is more impervious, and the surface soil more gravelly and consequently less fertile.

Certain of the rotation experiments were adversely affected by the impossibility during the war of obtaining the necessary supplies of seeds and fertilisers. As a result, the system of cropping and fertilising has, on these plots, not been uniform, and they are not dealt with in this report. This difficulty will have been overcome by 1923, when all rotations will have completed at least one full cycle under uniform cropping and manuring, and it is hoped about that date to present a special report dealing only with these experiments. Such fertilisers as were procurable during the war appear to have had very little if any direct or residual influence on the yield, and 1918 would appear to be the earliest year to which benefits due to the application of artificials can be attributed.

Maize is regarded as the crop of primary importance, and the success or otherwise of all systems of cropping practised is gauged by its effect on the maize yield. In order, however, to allow of all land being rotated and also to provide feed for pure-bred bulls and the 40 to 50 head of bullocks which are each dry season fattened on the farm, a large amount and variety of other crops are also grown. Until the season now opening, the bulk of these crops has been grown on the north-

eastern side of the farm, where the soil is particularly poor, and as a result yields have frequently been low. Where these same crops appear in the actual rotation experiments, it will be seen that their yields are considerably higher.

The following is a summary of the maize yields:—

Salisbury White Maize.—83 acres; second year land; unmanured; 12.57 bags per acre. 15 acres; 1920-21 fertiliser trials; second year land; 18.3 bags per acre. 22½ acres residual fertiliser trials; land under crop since 1913; organic fertilisers applied 1919-20; 10.93 bags per acre.

Rotation Experiments.—Commenced 1915-16; Salisbury White maize; land under crop since 1912.

1st Rotation.—Mangel, maize, velvet beans, oats; mangel crop always receives 7 tons dung per acre; maize received 150 lbs. complete artificials per acre in 1915-1916 and not again until 1920; maize yield 13.83 bags per acre.

2nd Rotation.—Maize, mangel, oats, velvet beans; maize follows velvet beans; mangel crop manured as in 1st rotation; maize crop has received 150 lbs. complete artificials every year except in 1919; maize yield 15.16 bags per acre.

3rd Rotation.—Velvet beans, maize, oats, maize, majortas, maize; majorta crop received 7 tons dung per acre. Yields: maize after oats 5.4 bags per acre (the maize in this plot was a thin stand); maize after majortas 15.25 bags per acre; maize after velvet beans 8.83 bags per acre.

4th Rotation.—Maize continuous; received 100 lbs. complete artificials per acre in 1915 and 7 tons kraal manure per acre in 1917-18. Yield 8.08 bags per acre.

5th Rotation.—Maize, mangel or potato, maize, velvet beans; mangel or potato crop receives 7 tons dung per acre; maize following potatoes receives 150 lbs. complete artificials per acre. Yields: maize after velvet beans 10 bags per acre; maize after potatoes 18.75 bags per acre.

The following rotations were commenced 1919-20:—

6th Rotation.—Maize, maize fertilised, maize, velvet beans ploughed under; fertilised maize receives 150 lbs. complete artificials per acre. Yields: maize after maize fertilised 12.4 bags per acre; maize fertilised 11.4 bags per acre; maize after velvet beans ploughed under 14.91 bags per acre.

7th Rotation.—Maize, maize fertilised, maize, sweet potatoes; maize fertilised as in 6th rotation. For unavoidable reasons the sweet potato plot was left down for two seasons. Yields: maize after maize 10.66 bags per acre; maize after maize fertilised 13.2 bags per acre.

8th Rotation.—Maize, maize fertilised, maize, velvet beans, oats; fertilised maize receives 150 lbs. complete artificials per acre. Yields: maize fertilised 10.7 bags per acre; maize after maize fertilised 14.7 bags per acre; maize after oats 13.6 bags per acre.

9th Rotation.—Maize, maize fertilised, maize, maize, velvet beans ploughed under. Yields: maize fertilised 13.16 bags per acre; maize after maize fertilised 13.08 bags per acre; maize after maize 10.3 bags per acre; maize after velvet beans 10.5 bags per acre.

The average yield of the 63 acres of maize in the rotation plots was 12.18 bags per acre.

Potchefstroom Pearl Maize.—Five acres grown on very poor maize soil. Average yield 6.52 bags per acre.

Hickory King 8-Row.—Forty-nine acres grown on very poor maize soil. Average yield 7.6 bags per acre.

The average yield over 183½ acres of Salisbury White maize was 12.7 bags per acre.

The average for the total 237½ acres of maize grown for grain was 11 bags per acre.

The total rainfall for the season, amounting in all to 26.71 inches, was poor, and its distribution was exceptionally unfavourable. These maize yields may therefore be regarded as extremely satisfactory. The land occupied by the rotation plots has been under crop since 1912. Maize has always been alternated with other crops, but systematic rotation trials were not commenced until the dates indicated.

The fact that throughout these rotations an average maize yield of 12.18 bags per acre was obtained, on land of no great natural fertility and with a very limited use of farmyard manure or artificials, is a definite indication of the manner in which fertility can be maintained.

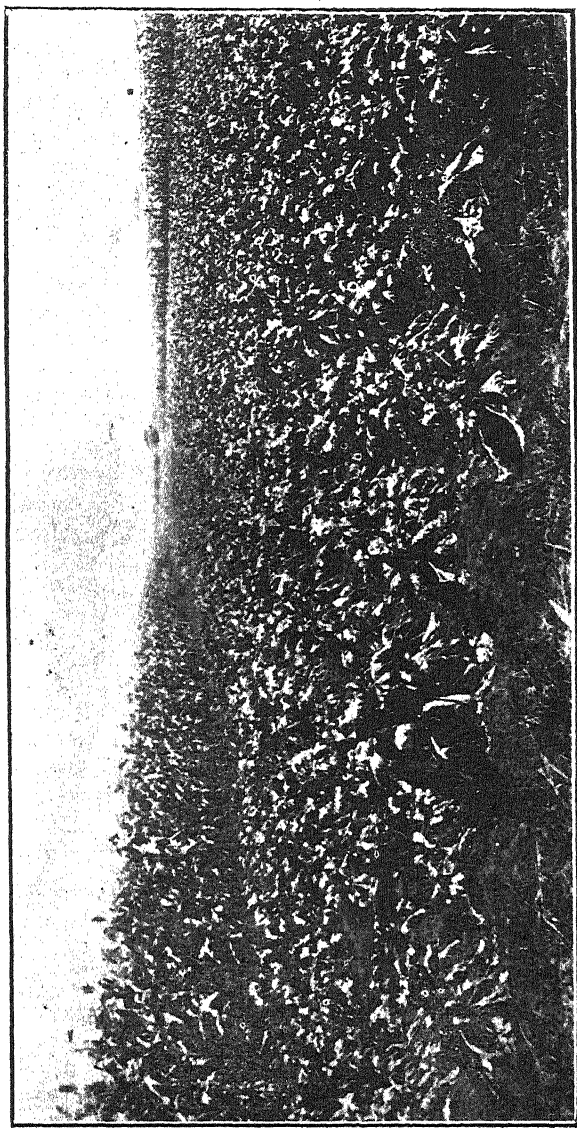
An unusual feature of this season's rotation results is the better yield in most cases obtained from maize after artificial fertilisers applied to the previous year's crop rather than from artificials applied direct. The reason for this may lie in the unfavourable distribution of the early rainfall, which from November to January was as follows:—

November	1.18 inches
December	3.75 inches
January	5.09 inches

Maize planting commenced on the 15th November, after a fall of 0.82 inch on the 10th. On the 18th November 0.21 inch fell, and subsequent to that there was no appreciable rain for 23 days until the 12th December, when 0.61 inch was registered. Another unusually dry spell of a fortnight's duration occurred between the 17th and 31st January.

When considering the yield of crops other than maize, it will be noticed that these are generally light. The reason for this, as has been stated, is the fact that in several cases they were grown on the north-east side of the farm where the soil is particularly poor.

Crops indicated by a cross were grown in and as part of the rotation experiments. Those indicated by an asterisk were grown on lands similar and adjacent to that occupied by the rotation trials, and are indicative of the general quality of this land when merely rotated and seldom if ever treated with farmyard manure or artificials.



Mangel crop in fifth rotation; maize plots on either side. Gwebi experiment farm.

Other Main Crop Yields.

- Buckwheat—*7 acres; 472 lbs. seed per acre.
 Ground nuts (Spanish)—*35 acres; 10 acres after field radish; 704 lbs. per acre; 12½ acres after ground nuts, 469 lbs. per acre; 12½ acres after wheat, 745 lbs. per acre.
 Linseed—*10 acres; 380 lbs. seed per acre.
 Linseed—6 acres; 400 lbs. seed per acre.
 Majortas—*6 acres; 4 1-10th tons per acre.
 Mangel—+3 acres; 4¾ tons per acre (poor stand).
 Mangel—+3 acres; 7 1-10th tons per acre.
 Mangel—+3 acres; 2¾ tons per acre (very poor stand).
 Manna—7 acres; 1,200 lbs. hay per acre.
 Manna—7 acres; 360 lbs. seed per acre.
 Niger Oil—*7 acres; 130 lbs. seed per acre.
 Oats, Kherson—14 acres; 720 lbs. hay per acre.
 Oats, Kherson—+3 acres; 1,680 lbs. hay per acre.
 Oats, Kherson—+3 acres; 1,850 lbs. hay per acre.
 Pea, Black-eyed Susan—*6 acres; 460 lbs. seed per acre.
 Potatoes—*2½ acres; imported seed; 18 bags (table) per acre; 17 3-5th bags (seed and small) per acre.
 Potatoes—*1½ acres; farm seed, grown 6 years on farm; 16 bags (table) per acre; 32¼ bags (seed and small) per acre.
 Pumpkins—*5 acres; 2½ tons per acre.
 Teff grass—4 acres; ½ ton hay per acre.
 Teff grass—10 acres; 392 lbs. seed per acre.
 Sudan grass—+1 acre; 120 lbs. seed per acre.
 Sudan grass—+2 acres; 2,700 lbs. of hay per acre.
 Sudan grass—*6 acres; 1,800 lbs. hay per acre.
 Tepary bean—*3 acres; 250 lbs. beans per acre.
 Sunflower—14 acres; 600 lbs. of seed per acre.
 Sunn hemp—8 acres; 118 lbs. seed per acre.
 Sweet potatoes—+3 acres; 4,500 lbs. tubers per acre.
 Velvet beans—18 acres; 6,600 lbs. green fodder per acre.
 Velvet beans—+3 acres; 1,053 lbs. hay per acre.
 Velvet beans—+3 acres; 1,705 lbs. hay per acre.
 Velvet beans—+3 acres; 1,690 lbs. hay per acre.
 Velvet beans—+3 acres; 2,100 lbs. hay per acre.
 Velvet beans—+3 acres; 1,270 lbs. hay per acre.
 Velvet beans—18 acres; 147 lbs. seed per acre.
 Velvet beans—+3 acres; 260 lbs. seed per acre.
 Florida beans—*5 acres; 840 lbs. hay per acre.

Pasture grass experiments have been in progress for some years, and the intention is to gradually lay down the entire lands on the north-east side of the farm to improved grasses. During the season under review the two grasses of which there was the largest acreage were molasses grass and Kikuyu. The former had been laid down in 1917-18 on a very poor gravelly red soil not capable of producing more than 3 to 4 bags of maize per acre. This sowing made a good stand, and in 1918-19 the crop was saved for seed, and after seed had been taken was mown in June. Little or no subsequent growth was made until the following wet season. In 1920 the treatment and results were similar,

and in 1921 the grass again reached a height of about 2 feet and commenced to seed freely, though it was noticeable that a considerable percentage of the plants had died out. Part of the acreage was saved for seed and part cut for hay. After cutting no fresh growth worth speaking of was made until rains fell in October. In winter, cattle herded on it refused to graze it, leaving it in favour of an adjoining field of Kikuyu grass. The hay was not relished by cattle or mules.

Fifteen acres of Kikuyu grass were laid down in January, 1920, on soil similar to the above. Slips were planted 2 feet apart each way, and in order to prevent weeds from seeding a mower was occasionally run over the field. By February, 1921, the grass had entirely covered the ground and had made a good thick sward, but never reached more than 4 to 6 inches in height except on ant-heaps, where it stood 9 to 12 inches high. It remained green and succulent until the end of July, and from April to that date was heavily grazed by young bulls and sheep. Very little growth was made from the end of July until the first rains fell in October, but throughout the whole winter there was more grazing upon it than on the adjacent molasses grass.

Two acres of Kudzu vine were laid down in January, 1921, but this crop requires at least two full seasons before it covers the ground, and there is nothing yet to report on this experiment.

Molasses grass, Napier fodder, Guinea grass and Indian cane were established in 1916-17, and Kikuyu grass in 1917-18, on a poor badly drained yellow clay soil. The first four did well for three seasons, but since then have gradually died out. The Kikuyu failed at any time to make strong growth. Molasses and Kikuyu still provided a certain amount of summer and autumn grazing in 1920, but since then have appeared unable to hold their own against weeds and veld grasses. This test, however, was a severe one, as the soil has never grown any crop satisfactorily except natural veld grass.

Reports on molasses grass grown in the Mazoe Valley are more satisfactory, and where frosts are not heavy this grass is said to remain green during the dry season.

The Turkey.

By A. LITTLE, Poultry Expert.

In view of the large number of poultry keepers who go in for turkeys, or are proposing to do so, and the large number of queries received on this subject, this article seems very necessary.

The majority of people are under the impression that young turkeys are difficult to rear, and many fail to do so successfully. The fault lies, firstly, in the choice of breeding stock, and, secondly, in the lack of suitable treatment. Provided these are remedied, turkeys do well and pay well, especially so in Rhodesia, for the country is particularly adapted for the purpose; further, there is a good demand both for breeding stock and table birds, the latter especially at Christmas.

We have in this country many months of dry, warm weather, in most districts a light and often sandy soil, and abundance of natural food and shade, all of which are most necessary for the successful rearing of turkeys.

The Origin of the Turkey.—The turkey came from North America and is the lineal descendant of the wild turkey. The Indians were the first to attempt its domestication. Some have suggested that its name originated from the resemblance of the red carunculations to the old Turkish costume of a red fez coming down to the ears, with a dark flowing robe underneath; or that the word is corrupted from "Turquoise," as applied to the bluish carunculations about the head; or from the fact that the designation "a Turk" is applied to anyone of a domineering or pompous disposition or appearance, and could also be applied to a turkey Tom.

There are seven varieties of turkeys, viz.:—The American Bronze (sometimes called the Mammoth Bronze owing to its size), which is the best and most profitable one. The other varieties are the Narranganset, Buff, White, Black, Slate, and Bourbon Red; these are smaller, and do not make such good table birds. The turkey should be pre-eminently kept for utility purposes, *i.e.*, size, vigour and quantity of meat. The American Bronze has a green bronzy sheen on the feathers covering the breast, back and neck. The tail feathers are brown, white and black equally distributed, and the feathers of the wings are barred alternately black and white; any colouring other than this in an American Bronze denotes a mixture of alien blood.

The Breeding Pens.—One Tom will take eight to twelve hens, and, if given a large free range, 18 to 20. These should be well matured, strong, healthy and vigorous, to produce good fertile eggs and strong chicks. No hen under one year old should be bred from; hens of this age lay more eggs than older ones, but those between one and two years old produce stronger chicks. The Tom should not be less than 18 months old to produce the same result. It is not advisable to keep turkeys for breeding from later than four years old. The whole of one clutch of eggs is fertilised simultaneously, and in Holland, Belgium and Northern France turkey Toms travel round in the same way as stallions do.

When choosing the Tom and his hens, it must be realised that the hen gives type and size to the progeny, the Tom bone, colour and vigour; therefore, for utility birds, *i.e.*, good large meaty ones, it is necessary to breed from the largest hens; if the Tom is large, all the better, but a medium-sized Tom and large hens are preferable to a large Tom and small hens. This point it is most necessary to emphasise, for in this country one frequently sees large Toms and small hens, whereas the hens should be tall birds with long deep bodies, broad backs and full rounded breasts, and with as big bones, feet and legs as possible.

Management of the Breeding Birds.—Having mated the birds well (and no bird with a suspicion of lack of vigour and constitution should be used under any consideration whatever), every egg laid should be accounted for and put down for hatching. A turkey hen, it is well known, is very prone to steal her nest and lay away; if allowed to do so, there is a risk of the eggs being lost or the hen and sometimes her young ones killed by snakes and other vermin. There are two methods to be adopted by which this loss can be obviated, *viz.* (1) to locate the nest and carefully (when the hen is off the eggs) build over them a shelter to prevent vermin reaching the turkey and her eggs, and placing in front of this, food (mealies), water, grit and charcoal; (2) a small wired-in enclosure should be placed adjacent to the house in which they roost; in this should be placed barrels or other receptacles of sufficient size to allow them to lay and sit in comfort. As soon as the birds start to lay, they should be confined to this pen till 10 or 11 a.m. to accustom them to these nests, and then allowed out on free range for the rest of the day.

Housing Turkeys.—A turkey house is very simple to erect. It should be large, with an open wire netting front; a good thickness of grass should be attached to wire netting on the sides and back, and a good water-tight roof provided. It should be of a good height, at least 8 ft. in front and 6 ft. at the back, and 8 ft. to 10 ft. deep, and of any width according to the number of turkeys to be housed. The roosts should be at least 4 ft. from the floor, running from side to side. Such a house is cheaply and easily constructed. The method, often adopted, of allowing the turkeys to roost in sheds, trees, etc., results in loss or lessened profits. *Fresh, sweet ground and free range* are absolutely necessary if the turkeys are to thrive well and make good profits; if too closely confined they will not do so, but the bigger

range they are given the better they will lay and the stronger and more vigorous they and their progeny will be. Further, if they run with fowls and ducks it is well nigh hopeless to attempt to rear the young ones and keep the adults in good, strong, healthy condition. This is one of the chief causes of many failures to rear good turkeys and make them the profitable proposition they can be made. A turkey cannot possibly thrive on hard, beaten down, tainted ground. The farms of Rhodesia, with their extensive lands, grass and bush, are ideal for turkey raising, and they should be run in large flocks, herded by a piccanin in exactly the same manner as the cattle are, and when brought back at sundown, given a few mealies in their roosting house. They will *not* do well in small, crowded quarters. Further, when on extensive free range they obtain all the natural food they require, the only expense incurred being the pay of the herd boy and for the few mealies at sundown mentioned above, also for the little extra food it is necessary to give them for a fortnight or three weeks before marketing.

Hatching.—The sitting hen should have food, water, grit and charcoal within easy reach of her nest, and she should be disturbed as little as possible, for she is usually very sensitive and nervous when sitting and is apt to forsake her nest. For 24 hours after the eggs are due to hatch she should be left severely alone till the chicks are well out and have gained strength; then dust her and the chicks with some good insect powder and put them in a good, roomy coop, with plenty of grass on the floor and wooden slats in front, in and out of which the young chicks can run at will.

Rearing.—If this is done with a turkey hen, the coop in which she and the chicks are located should be placed in a shady spot where the grass is short and the ground untainted and fresh; it must be moved regularly every day ten to fifteen yards from the spot it occupied the previous day. Continue this for ten days or a fortnight, after which period the chicks will be sufficiently strong to follow the hen; then let her out all day and every day except when it is wet or the ground is damp. Wet weather and damp ground are usually fatal to the young turkey chicks, and it is as well to have a comfortable dry grass shed well littered down with soft, short, dry grass in which they can be confined in wet weather.

Artificial incubation is preferable if an incubator is available, for by taking the eggs away as they are laid (leaving, of course, one in the nest) the hens continue laying and no time is lost by the hens sitting, and a larger flock is thus more quickly raised. When this method is adopted, allow the chicks to rest and sleep in the drying box for 24 or 36 hours after hatching; they should then be taken out and placed in a cold brooder with a movable wire run attached, which should be moved each day on to fresh ground.

The feeding of chicks hatched under hens and in an incubator is similar. Do not give *any* food for 24 to 36 hours after hatching, then give grit and charcoal as a first feed. Both are most necessary at this period and at all times of a turkey's life. Many young turkeys are

killed by over-feeding; they should always be kept a little hungry, for, if overfed, especially at an early age, they begin to droop and die at about three weeks old.

After they have had a sufficiency of grit and charcoal as mentioned above, give them a little stale bread soaked in separated milk and squeezed out dry, or boiled rice treated in the same way, but it *must* be dry, for wet food given to turkey chicks, especially if it is trampled upon, becomes dirty or sour, and this is fatal to them. This is one of the principal causes of non-success so many people experience in the rearing of young turkeys. They do best on dry food; in fact, it is the only method of feeding if success is to be assured, and is quite simple. The only grains required are mealies (crushed), munga and a little linseed. This mixture should be put in a thin layer of chopped dry grass, or, better still, chaff; thick separated milk should always be before them in a shallow receptacle. Chopped onion tops should be given four or five times a day in addition to lettuce or other green food; also in another receptacle a mixture of equal parts of *dry* bran and mealies, with a little powdered charcoal; water (which must be kept out of the sun), grit and charcoal must always be before them. When they are six weeks or two months old, they can be allowed free range under the care of a piccanin.

Diseases.—The chicks are liable to indigestion and white diarrhoea if not given sufficient grit and charcoal, or if they are overfed, especially with wet food. These diseases are also caused by allowing them to get wet. Chicken pox or warts is another disease that affects turkeys; the treatment is to immediately isolate those affected and apply carbolised vaseline and give ample green food. Roup sometimes appears, and careful watch should be exercised. Immediately a case is noticed, the bird should be killed and the body burnt, for it is a most contagious disease and will rapidly run through the whole flock. Blackhead also is a very contagious disease affecting turkeys. The symptoms are darkening of the head, rapid weakness and emaciation, diarrhoea of a yellowish-green colour and sleepiness. A bird showing these symptoms should be at once isolated and treated as follows:—One teaspoonful of Epsom salts in two tablespoonfuls of warm water, followed by Douglas mixture in the drinking water. Give no mealies.

The insects attacking turkeys are lice, grey ticks and fowl ticks, and careful watch for these should always be exercised. The two former attack principally the young chicks, and they are the cause of more deaths than anything else. The application of carbolised vaseline will kill them. Fowl ticks also are very fatal to turkeys. Full particulars of these insects are given in the *Rhodesia Agricultural Journal* for December, 1920, and Bulletin No. 377.

SUMMARY.

- (1) Choose as breeding birds only strong, healthy, vigorous Toms and large hens.
- (2) Keep the young chicks dry.

- (3) Feed only on dry food.
- (4) Give abundance of thick separated milk and chopped onion tops.
- (5) Do not overfeed; on the other hand, do not starve the chicks.
- (6) Do not run chicks or adults with fowls or ducks.
- (7) Give plenty of free range and *always* fresh, sweet ground.

Rhodesia is pre-eminently suited for turkey keeping. The climate and soil generally are excellent for the purpose, natural food is abundant and range unlimited.

There is no reason why, if the foregoing advice is followed, we should not have, in course of time, large flocks of turkeys herded by boys, running over many of the farms in this country and becoming a very profitable side line (many already find it so), for the demand for breeding stock and table birds is excellent, at prices for the former of from 21s. to £5 5s. each, and for the latter at 1s. 3d. to 1s. 6d. per lb. live weight.

Merino Rams for Sale.

A limited number of merino ram lambs, six months old, are available for sale from the Gwebi experiment farm. Price £2 2s. each f.o.r. Gwebi farm spur.

Report of the Veterinary Bacteriologist of Southern Rhodesia

FOR THE YEAR 1920.

The *routine work* of the office, laboratory and inoculation station has occupied the time of the staff, to the exclusion of any serious research in connection with the many obscure diseases affecting stock in this country.

The examination of smears and pathological specimens has been carried out entirely by the Bacteriologist himself, an early and accurate diagnosis being a matter of considerable importance in the prevention and suppression of stock diseases. It must be borne in mind that many of these smears are imperfectly prepared, thus adding considerably to the difficulty of the work. The following table shows the number of preparations received and the principal diseases detected:—

PREPARATIONS RECEIVED FOR DIAGNOSIS.

Month.	Total.	African Coast Fever.	Infectious abortion.	Quarter evil.	An- thrax.	Try- pano- somi- asis.	Tuber- culosis.
January ...	119	13	—	7	2	—	—
February ...	219	38	3	11	1	—	—
March ...	158	16	—	8	1	3	—
April ...	155	16	—	19	—	2	—
May ...	147	7	12	24	2	—	—
June ...	162	24	15	18	—	—	—
July ...	99	10	3	11	2	—	—
August ...	151	5	7	9	4	—	—
September...	156	12	16	9	—	—	—
October ...	160	17	4	7	2	—	3
November ...	181	5	6	4	2	—	—
December ...	120	4	9	6	—	—	1
Total ...	1,827	167	75	133	16	5	4

Infectious Abortion of Cattle.—Some 36 new areas of infection have been detected during the past year, and it is now realised that this very serious malady is far more widely distributed than was anticipated. It is stated that it is very prevalent among cattle owned by natives, who, recognising the disease, deliberately dispose of infected

animals, thus no doubt disseminating infection. European cattle dealers also are by no means guiltless in this respect. This disease is sometimes detected by the fact that one or two cows abort, and is promptly dealt with before any large number of animals have become infected; but in the great majority of cases it is probable that many abortions take place unknown, and it is only by an abnormally small calf-crop that its presence is realised. The collection of blood by the pipette method devised at this laboratory has enabled the existence of the disease to be detected by means of the agglutination test, and early steps to be taken. The procedure adopted is in most cases that laid down at a conference of the professional officers of the Veterinary Department, held in the veterinary laboratory in August last.

(NOTE.—*The procedure referred to is outlined in the article appearing in this issue, "Infectious Abortion of Cattle and its possible Relation to Human Health."*)

The vaccine referred to as a "de-vitalised vaccine" is that prepared at this laboratory, and is so called to distinguish it from a "dead vaccine" containing organisms destroyed by heat. The method employed in its preparation is intended to conserve as far as possible the integral properties of the organism and its toxins, but to render them incapable of infecting pregnant animals or setting up a new focus of infection, as might be done by the use of a "living vaccine." Notwithstanding the general condemnation of "dead vaccines" in the treatment of this disease, the following table indicates that the use of the so-called "de-vitalised vaccine" prepared at this laboratory has been such as to justify its general application. While it is fully recognised that infectious abortion of cattle is a disease which tends to "wear itself out," the favourable results reported cannot be entirely attributed to this natural process, which is more calculated to "wear out" the owner than the disease from his cattle. The remarkable cessation of the abortions in treated herds after the vaccination process cannot fairly be attributed to the establishment of immunity by the natural process. In untreated herds such favourable results have certainly not been observed; on the contrary, the infection has continued with increasing severity. The conditions upon which this "wearing out" process depends are such as cannot be applied in this country without financial disaster.

INFECTIOUS ABORTION.

Table showing Result of Treatment of Infected Herds by Vaccination.

Number of outbreak.	District.	Number of females involved.	Number of bulls.	Number of abortions prior to treatment.	Date of first vaccination.	Abortions during treatment.	Abortions after treatment.	Subsequent calving.
1	Rusape	140	5	10	1918 October	Nil	Nil	Normal calving; 80 per cent. cows have yielded healthy calves.
2	do.	70	2	13	December	Nil	Nil	Normal calving; 90 per cent. cows have yielded healthy calves.
3	Headlands	130	3	2	do. 1919 July	Nil	Nil	Normal calving; 120 healthy calves.
4	Rusape	98	2	2	do. 1920 June	Nil	1	Normal calving; 75 healthy calves.
5	Inyazura	144	1	5	do.	Nil	5	Normal calving; 80 healthy calves.
6	Odzi	298	4	24	June	Nil	2	Normal calving; 70 healthy calves.
7	Rusape	360	?	40	August	Nil	Nil	No report.
8	Headlands	150	2	25	do.	Nil	Nil	Normal calving; 40 healthy calves.
9	do.	129	15	20	October	Under treatment	do.	No report.
10	Rusape	117	2	4	December	do.	do.	do.

11	Umtali	940	13	430	September	15	Nil	Normal calving.
12	Bromley	151	3	25	August	5	Nil	Normal calving; 20 healthy calves.
13	do.	127	3	2	October	Nil	Nil	Normal calving; 96 healthy calves from 100 cows.
14	do.	99	3	15	June	9	Nil	Normal calving.
15	Salisbury	127	2	10	October	Nil	Nil	Normal calving; majority of calves born before treatment.
16	Macheke	150	3	10	April	4	Nil	Normal calving; over 40 healthy calves.
17	Marandellas	65	2	4	do.	Nil	Nil	Normal calving.
18	do.	95	1	23	June	10	Nil	do.
19	do.	150	3	18	November	Nil	Nil	No report.
20	Umvuma	130	3	11	September	Nil	5	Normal calving.
21	do.	148	2	20	do.	Nil	4	do.
22	Felixburg	103	3	81	October	Nil	Nil	Still under treatment.
23	Selukwe	118	2	15	December	Nil	2	do. do.
24	Gwelo	97	3	?	do. 1919	Under treatment	do.	do.
25	Sinoia	77	2	6	January 1920	Nil	Nil	No report.
26	Beatrice	46	2	11	July	2	Nil	do.

Note.—It is not considered desirable to publish the names of the owners of infected herds. These have been given in a departmental report.

It will be noted that in 17 out of 21 outbreaks where the full treatment has been applied the occurrence of abortion has completely ceased; in others, the number of cases has been materially reduced. A remarkable observation has been made by more than one veterinary officer in charge of the treatment of infected herds, namely, that when cows in milk are vaccinated it sometimes happens that a well-marked re-action is noticeable in the udder, and that the milk supply temporarily diminishes. Knowing that the organism becomes established in the udder of infected animals, which may thus become "carriers," this re-action suggests that the vaccine exerts a definite and specific effect, and in view of recent observations published in the medical press showing that "carriers" of typhoid fever and diphtheria may be "cleared up" by massive doses of appropriate vaccine, it is to be hoped that the inoculation of "carriers" of infectious abortion may produce a similar and much-to-be-desired result. As the result of the success following the use of the local vaccine, there has been an enormous demand for it, but unfortunately, owing to the lack of facilities and apparatus, it has only been possible to produce some 14,000 doses. When it is remembered that each dose represents as many as 25,000,000,000 bacteria, and that each brew of vaccine is carefully tested against known specific sera obtained from field sources, that is to say, from animals which have aborted as the result of natural infection, the magnitude of the work, performed as it is in a stable store-room, may be appreciated. Three injections of vaccine have been applied at intervals of one month between the first and second and two months between the second and third periods, based upon the agglutination cure observed in experimental cases. The testing of bulls has yielded interesting information concerning the part played by them in the infection of the herd. In four outbreaks, bulls have re-acted to the agglutination test, and, on re-testing after an interval of three months, have again shown a positive re-action. In view of the observation of Schroeder indicating that the bull may become a carrier or permanent reservoir of infection, owners of such re-acting bulls have been advised to castrate or destroy them. If a bull re-acts to the first test, it is not vaccinated, for the reason that the agglutination re-action to the vaccine would interfere with the second test. The results obtained by these methods would appear to justify the hope that by the early detection of the disease by the simplification of an otherwise impracticable laboratory test, and the application of a specific and successful vaccine, this insidious and costly disease may be controlled and eventually eliminated from this country. To this end, however, the co-operation of stock owners is a necessary factor.

Horse-Sickness.—It is satisfactory to be able to report that considerable progress has been made during the year in our method of inoculation of horses and mules against horse-sickness. Not only has a virus-vaccine of suitable virulence been discovered, but the method whereby large quantities of it may be obtained has been determined. It may be explained that the process of immunising the animal consists of conveying to it a mild attack of the disease from which it can recover, and in so doing derive immunity. It therefore follows that the natural susceptibility or resistance of the animal is an important

factor, for it has been found that similar virus may kill one animal, but cause no re-action in another. The selection of a suitable virus is therefore a matter of some difficulty, inasmuch as it must be sufficiently strong to cause a re-action in the resistant, but not so strong as to kill a highly susceptible horse. Moreover, the susceptibility of the animal is to a large extent an unknown quantity. It has, however, been shown by experiment that mules possess a considerable degree of resistance, and that a virus which would kill most horses can be well tolerated by mules. Advantage has been taken of this fact, and during the past year 511 doses of vaccine have been issued and applied to mules, with but one death. Although the effects of inoculation in these animals have often been inappreciable, the strong immunity conveyed is shown by their resistance to natural infection when exposed in districts notably bad for horse-sickness. A similar but less marked resistance is also possessed by most young horses, and a system of inoculation has been applied to 516 horses under the age of two-and-a-half years, with a loss of 28 animals or 5.42 per centum. The following table shows how this method has been applied by the veterinary officers of the various districts and the results obtained by them. It may be explained that the operation is performed only by the professional members of the Veterinary Department, to whom I am greatly indebted for their co-operation and enthusiastic assistance.

INOCULATION OF YOUNG HORSES AGAINST HORSE-SICKNESS.

District.	Doses issued.	Doses not ac- counted for.	Animals inoculated.			Number of inoculation.			Result.		Mortality of horses per centum.
			Horses.	Mules.	Total.	1st.	2nd.	Re-inoculation.	Died.	Re-covered.	
Victoria	180	27	56	9	65	54	11	38	7	58	12.5
Gwelo	372	97	207	46	253	209	34	32	11	236	5.31
Melsetter	108	37	55	16	71	51	20	—	1	71	1.81
Bulawayo	288	61	88	139	227	223	4	—	4	223	4.54
Salisbury	317	64	58	200	257	252	1	—	2	255	3.44
Umtali	67	13	52	2	54	54	—	—	3	51	5.76
	1,282	299	516	412	928	843	70	70	28	894	5.42

A difficulty has arisen in the inoculation of those young animals, for it has become evident, as the result of experience, that the degree of resistance varies in different animals, and that some refuse to react to the virus-vaccine and thus derive no additional immunity from it. But the resistance which may be sufficient to overcome the virus-vaccine dies out with increasing age, and the animal is thus left as susceptible to natural infection as an untreated animal. This resistance has been thought to be greatest in foals from so-called "salted" parents, and to be associated with the milk of an immune mother; it has therefore been decided to postpone when possible the inoculation of young horses until after they are weaned. In view of the danger of the natural immunity of a non-re-actor dying out, it is recommended that the inoculation be applied yearly. Seventy animals have been re-inoculated during the season, with two deaths. In my report for the year 1919 it was stated that 207 young horses had been inoculated, and reports have been received of the death of twelve only of these animals. It would appear that many of these can be attributed to careless treatment. It has been found that inoculated horses not infrequently suffer from a re-action due to re-infection on exposure to a natural virus of different strain to that against which they have been immunised, but the great majority of such animals recover if the re-action is detected and the animal is carefully tended. This is well proved by the fact that of 286 inoculated Police horses exposed during the past year, only two died of horse-sickness. The greater mortality of privately-owned horses suggests that they are not treated with equal care; nevertheless, it is the reputation of the method of inoculation which suffers. The figures show an increasing number of young horses in the country, which may be largely attributed to the success of the inoculation process. Upon this foundation it is hoped to build up the horse-breeding industry, and already the need for suitable sires for this purpose has become apparent. While the inoculation of young horses has been entrusted to the District Veterinary Surgeons, the immunising of older animals has been entirely under my own supervision. As will be seen from the attached table, 267 horses have thus been inoculated during the year under review, the average age being approximately five years. Many horses exceeding that age have been successfully treated, but the high mortality (7.86 per cent.) is to a large extent due to the death of such older horses. It has been found, however, that age is not such an important factor as "condition," and it is a notable fact that fat, pampered and stable-fed horses are a "bad risk." On the other hand, weak and emaciated or under-fed horses are equally so; for which reason it has not been considered desirable to issue the vaccine for the general inoculation of horses belonging to the public. Horses in good hard-working condition are the best subjects, and two racehorses were taken from the racecourse, and after a few days were inoculated, with most satisfactory results. The importation of well-bred sires, which can first be raced and then inoculated before being sent to outside districts for stud purposes, might be considered by those interested in racing and anxious to improve the class of horse in the country. During the year a large number of remounts have been

imported for the British South Africa Police, and 176 have been inoculated by me, with the assistance of the Farrier Sergeant-Major and staff at the Drill Hall stables, which have been handed over to me for the purpose. In addition, three horses for the Northern Rhodesia Police have been treated. Unfortunately the work has been rendered more difficult by the occurrence of strangles, which has frequently complicated the horse-sickness re-actions; nevertheless, the death rate of 7.26 per cent. is an improvement on the 13.8 per cent. for the previous year, and may be considered satisfactory in view of the fact that horses were inoculated as they came forward, without consideration of age or condition. If it is conceded that an inoculated horse is enhanced in value by £10—which current market reports will show is a low estimate—and the value of an inoculated remount is taken at £30, the work shows a profit of £1,270. But, apart from this, the usefulness of the horse for Police purposes is enormously increased, as it can now be used for patrol purposes at any time and in any district with impunity, provided reasonable care is taken in the event of a re-action, as previously discussed. Figures supplied by the Chief Staff Officer show that on the 1st January, 1920, some 220 horses were on the Police strength, of which 146 were inoculated animals, while the number on strength on the 31st December, 1920, was 332, including seven private animals, of which number 286 were inoculated animals. As a proof of the efficacy of the inoculation, it may be noted that only two of these inoculated horses died of horse-sickness during the year, in spite of the risks of natural infection to which Police horses must necessarily be exposed. The method has recently been applied to 41 horses imported for distribution to Cattle Inspectors, with but one death. This was the last batch of horses to be inoculated, and the reduced mortality (2.43 per cent.) shows a marked improvement as the result of the year's work.

HORSE-SICKNESS.

*Horses Inoculated during 1920 by Government Veterinary
Bacteriologist in Salisbury.*

			Deaths.	Per cent.
Police horses	176	}	179	13
Northern Rhodesia Police horses ...	3		47	7
Experimental			41	1
Veterinary Remounts				
Total			267	21
				7.86

Cost of Experiments:—

Enhanced value of inoculated horses at £10 each ...	£2,460
Cost of horses dead at £30 each	630

Total profit ... £1,830

Plasmoses of Cattle.—During the year, vaccine has been issued for the inoculation against redwater and gall-sickness of young cattle upon farms where dipping has been practised for some time, and ticks which transmit these diseases have been eliminated. Cattle bred upon

such farms do not contract these diseases in their early days, and grow up without that immunity which follows recovery from natural infection, so that when removed to areas where dipping has not been practised so long or where ticks have not been completely removed, are liable to contract tick-borne diseases in an acute form. To provide against these disadvantages associated with dipping, the inoculation of calves with a standardised attenuated virus is recommended, and has proved very satisfactory. Although the demand has not been as great as was anticipated, this is probably due to the fact that the purpose and usefulness of the method is not generally understood. A great improvement has been made in the method of inoculation by adopting a "double process," that is to say, by inoculating animals first with a very mild virus, which partially protects them against a second virus sufficiently strong to render them immune against natural infection. This method has been applied to valuable animals from overseas which could not have been inoculated by the old "single" method without grave risk. Forty-three animals have been thus treated, with but one death, a great improvement on previous results. It is therefore hoped that it may soon be possible to issue virus to be applied by farmers themselves to their imported and older improved stock on their own farms. A number of well-bred animals purchased for Portuguese East Africa have been inoculated *en route*, and the results have proved highly satisfactory to the buyers. The Acting Principal Veterinary Officer of the Mozambique Territory suggests that the application of this method may open up a good trade in Rhodesian pure-bred and grade stock in that country.

Quarter-Evil.—The increasing prevalence of this disease has drawn attention to the necessity for preparing locally a vaccine for the protection of our stock. In the absence of suitable accommodation and facilities for the isolation of infected animals and disposal of carcasses and contaminated material, this has been impossible, and we have had to rely upon materials supplied from other countries. This has not been entirely satisfactory, owing to the delays in the delivery of supplies and the alterations which appear to have taken place in transit, notably in the case of so-called germ-free preparations, which contain only the toxins of the organisms, and are particularly susceptible to the effects of exposure to heat and light. It has been observed that in a considerable number of outbreaks in which such preparations have been applied, cases continue to occur; either the animals have derived no immunity, or the immunity conveyed has rapidly died out. Several reasons may be suggested to account for these failures, as, for example:

1. The vaccine may be of a "strain" differing from the local "strain," and does not convey complete protection against it.
2. The virulence of the vaccine may have died out or have become attenuated.
3. The full dose of the vaccine may not have been introduced—
 - (a) through the restlessness of the animal, or carelessness of the operator;
 - (b) the dose prescribed being too small for accurate measurement;

- (c) the powdered muscle having deposited from suspension, and the supernatant fluid taken up in the syringe containing insufficient vaccine.

The re-inoculation of herds where cases continue to occur has not always resulted in the cessation of the disease, and the most probable explanation is that the first vaccine applied, although not producing in certain animals sufficient immunity to protect against natural infection of full virulence, may in the majority of animals give rise to sufficient immunity to prevent a re-action to a second injection of vaccine of attenuated virulence. On the principle of "no re-action, no immunity," animals which fail to re-act to the second, and in some cases third, injection derive no benefit therefrom, but when the partial immunity due to the first vaccine has died out are as vulnerable as untreated animals. Two preparations have proved successful in arresting the disease even in these "persistent" outbreaks, and it is intended when the new laboratory is available to elaborate a method of protection prepared from the local strain of virus and based upon the principles upon which these vaccines are prepared.

Auto-Vaccines.—These have been prepared at the laboratory from material collected by veterinarians in the field, and have been applied with considerable success in the treatment of a number of purulent infections, such as mammitis, vaginitis of cattle, septic lymphangitis following the bite of the "striped legged" tick (*H. aegyptium*), strangles in horses and pyæmia in dogs. Those using the vaccines, which are prepared in a very simple and rapid manner, speak enthusiastically of the results obtained. It is proposed to carry out further experimental work with a view to applying the method in the treatment of many similar diseases.

Inoculation Camp.—During the year, 64 animals have been received, 43 of which have been inoculated, the remainder being received for treatment. One death occurred during inoculation. Many of these cattle have been very valuable animals, and it is estimated that more than £7,000 worth of stock has passed through the camp. The cost of feeding these animals has been considerably reduced by using the crops grown on the station. For example, Napier fodder to the value of £15 to £20 per mensem has been grown, except during the months of August and September, when ensilage prepared from it was available. Various improvements have been made on the station; roads have been made, trees planted and the land cultivated. The general value of the property has been greatly enhanced.

Revenue.—Every effort has been made to run the Division as economically as possible, and to render it self-supporting. The lack of accommodation and equipment has limited the preparation of saleable products, but notwithstanding these difficulties, a sum has been earned during the year more than sufficient to meet all expenditure. It is impossible to submit a detailed financial statement, the accounts being kept by other departments, but the following figures show the revenue derived from the sale of vaccines and inoculation fees:—

Horse-Sickness Vaccine.

843 doses for 1st injection at £1 per dose	£843	0	0
70 doses for 2nd injection at 5s. per dose	17	10	0
70 doses for re-inoculation (free issue)			
299 doses not accounted for	299	0	0
179 doses for Police horses (book entry)	179	0	0

Infectious Abortion Vaccine.

14,406 doses at 1s. per dose	720	6	0
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Redwater and Gall-Sickness Vaccine.

678 doses at 1s. per dose	33	18	0
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Inoculation Camp.

Fees for inoculation and treatment of cattle	452	4	6
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Total £2,544 18 6

Southern Rhodesia Settlers' Board.

PRESIDENT'S REPORT AS AT 30TH SEPTEMBER, 1921.

During the last quarter 131 enquiries have been received and dealt with, of which 13 were from England, 44 from the Union of South Africa, 41 from India and 33 from men already in Rhodesia. These are made up as follows:—70 are from men who are desirous of starting farming and who are apparently in a position to do so, 46 are from men seeking salaried positions on farms, 15 are from men who require tuition prior to taking up land on their own account. Of the 44 applications from the Union of South Africa only seven were from men apparently able to purchase land and take up farming; the remainder were applications for employment.

It is of interest to note that the Board has now been in active existence for 12 months. During this period 637 applications have been dealt with. Of this number 54 are known to have purchased land, 65 have been placed on farms for tuition and 60 have found employment on farms. Thus 179 persons have been as it were started in this country exclusive of the wives and families of those who are married, which, if included, would certainly bring up the total number of persons introduced into the country to over 200. A moderate estimate of the amount of capital introduced by these persons may be taken as £150,000.

Owing to the lack of suitable response from the Union of South Africa it is proposed to withdraw some of our press advertisements in that territory (but not all), and to expend any sum thus saved on

posters for distribution at the coast ports. The Board have recently arranged to co-operate with the 1820 Memorial Settlers' Association, of which His Royal Highness the Governor General and Lieut.-General the Right Hon. J. C. Smuts are Honorary Presidents, and Brigadier General the Hon. Sir Charles Crewe is Chairman. This Association is doing exactly the same work in the Union of South Africa as the Settlers' Board is in Southern Rhodesia, and it has undertaken the distribution of posters referring to Rhodesia through the agency of its offices at the Cape ports.

With reference to settlers from the United Kingdom the Secretary reports that while he has been in England he has arranged for a fresh system of advertising, which it is thought will be more likely to reach the right type of settler than previous advertisements which have been inserted in one or two of the larger papers only.

The Secretary further reports that he spent a month working at the Rhodesia Enquiry Office, 138 Strand, during which time he was able to do much to co-ordinate the work of that office with the work of the Board here, and to institute a system of co-operation between the two offices, which will and indeed has already proved extremely useful. The Secretary reports extremely favourably of the usefulness to Rhodesia of the Strand Enquiry Office, and the helpful and sound information which all enquirers receive there. Arrangements have been made for the Board to supply the Strand Enquiry Office with a monthly report to enable them to keep their information as up to date as possible.

The falling off in response to advertisements in Great Britain and in the Union of South Africa is probably directly traceable to financial stringency in those countries. The Board feel that the policy hitherto pursued is the right one, and propose to continue it to the extent that the funds at their disposal will allow.

The Board began to advertise in India at the beginning of August, since which date 41 applications have been received from Civil Servants, Army Officers and others, all of good standing, who have some capital and have or will be in receipt of pensions.

The London Office has circularised all clubs of note in India drawing attention to the Board and its objects, and the Chairman of the British India Steam Navigation Company has been approached with a view to securing reduced fares for *bona fide* settlers coming out here under the auspices of the Board. It will be seen, therefore, that the Board is taking all reasonable means to profit by what appears at the moment to be the most favourable source of new settlers. Within the Territory arrangements are being made with the railway authorities for the distribution of a small handbook on Rhodesia in the dining cars, at the Falls Hotel and so forth, and for the exhibition of posters and advertisements on the railway stations and in the dining cars.

Of the Woodville Estate plots which were placed in the hands of the Board for allotment, eight have been definitely allotted, leaving four still unallotted. The Government have decided that the plots still unsold may be purchased by applicants approved by the Board on the same terms as they were offered to returned soldiers, except that they must be paid for in five instalments instead of ten.

Wheat.

Wheat and its Cultivation, by A. E. V. Richardson, M.A., B.Sc., published in the form of Bulletin No. 22 of the Department of Agriculture, Victoria, contains a most valuable and exhaustive account of wheat growing in Australia. The bulletin, from which the following extracts are taken, consists of 160 pages, and is full of interesting information. It is impossible here to do more than quote a few passages which will be of special interest to Rhodesian wheat growers.

The average acre yield as shown by Mr. Richardson is equivalent to approximately 4 bags per acre.

Rate of Seeding.—"The average amount of seed for grain is 45-60 lbs., while for hay and forage 1 to 2 bushels may be used. For grain the amount sown may be as low as 30 lbs. in dry mallee districts to 65-70 lbs. in moister districts. Generally speaking, sow early crops thin and late crops thick; sow light land thicker than rich, heavy land; and be sparing with good stooling varieties, and correspondingly liberal with varieties of poor capacity. About 20-25 per cent. more seed is required with the broadcaster to give the same braird as the drill."

Method of Sowing.—"Since the introduction and general use of superphosphates in the wheat-growing areas of the State, the old broadcaster has been superseded by drills, which sow seed and manure through the same holes.

"The advantages of broadcasting are: (1) The small cost per acre; (2) the large areas that may be sown in a day. The advantages possessed by a drill more than outweigh those of the broadcaster. With the drill, seed and manure may be sown in the one operation. This not only economises labour, but it also enables young plants to rapidly find the superphosphate and make vigorous growth in the earlier stages of their existence. Moreover, with the drill the germination is far more regular, because it is sown at a uniform depth. Finally, the depth of sowing may be regulated with the drill to suit the condition and nature of the seed-bed."

Grading of Seed.—"If there is one thing that has been conclusively demonstrated by carefully conducted experimental work it is the fact that plump grains are greatly superior to shrivelled grains from a productive point of view. Great emphasis must be laid on the necessity for the selection of hardy, vigorous prototypes, because, under favourable conditions, small but well-developed seeds from highly productive, vigorous plants may give better results than large grains from unproductive plants."

After-Treatment of Wheat.—"Rolling the crop after it has grown some 6 to 8 inches is frequently practised. With hay or ensilage this is often beneficial, as it helps to make a level surface for the binder, thus facilitating the harvesting of the crop. Moreover, on light, open land the consolidation of the soil effected by rolling is very beneficial to the growing crop. On heavy lands which tend to set hard, and which are likely to run together with the winter rains, the roller should be displaced by the harrows."

"Harrowing is always beneficial to a young wheat crop, provided it be not already too thin. Certainly a percentage of the young plants is dragged out in the operation, but it is well in this connection to remember the healthy proverb: 'The man who harrows should never look behind.' This disadvantage is more than compensated for by the increased vigour of the remaining plants, and by the great stimulus given to stooling; nor must it be forgotten that the harrows assist in subjugating the weeds, and in drier portions of the State assist in conserving the limited supplies of soil moisture by retarding capillary activity and lessening evaporation. In harrowing the crop, the work should be done at right angles to the drills."

Feeding down the Crop.—"It has already been remarked that, in favourable seasons, the early sown crops are likely to come away very rapidly and make heady, vigorous, rank growth in May and June. Such heady growth is exposed to two dangers: (1) lodging in wet weather; (2) blighting wither from late spring frosts, or by a premature burst of hot weather in spring.

"Such growth may be arrested by feeding down with sheep. This is a decided advantage on light land or on land which has, for various reasons, not been consolidated sufficiently through adequate tillage operations; but on heavy land it may be a positive disadvantage to feed down a crop with sheep. One point must not be overlooked in this connection, and that is the time such operations may with safety be performed. Late feeding down is generally decidedly detrimental, and can only be performed with any prospect of success when the spring rains are frequent and copious."

Methods of Cultivation.—"The nature of the Australian climate is such as to render thorough tillage a prime factor in successful wheat cropping. . . . More, however, is required than this. No system of cultivation can be permanently effective and adequate unless it makes provision for the maintenance of the fertility of the soil. . . . The fact that there are wheat lands in this young State which practical farmers and the Press frequently describe as 'worn out' shows that this aspect is frequently ignored. Methods which lead to the conservation of moisture, but not to the conservation of soil fertility, may be temporarily effective and profitable, but ultimately they must be disastrous both to the farmer and to the community."

"Wheat may be grown under three different systems of cropping: (1) continuous cropping with wheat; (2) wheat after bare fallow; (3) wheat in rotation with other crops."

Continuous Cropping.—"Continuous cropping with wheat is very general in countries where methods of cultivation are extensive rather than intensive. In the early stages of a new country, lands are cheap and even free; capital and human labour comparatively scarce and dear. To suit these circumstances, large areas are sown under pioneer conditions of culture. Large areas under crop and small average returns per acre are the rule. While it may be said that continuous growing of wheat on the same land year after year is not good practice, the results obtained in the Broadbalk field at the Rothamsted Experiment Station show that it is possible. For example, wheat has been grown continuously in the Broadbalk field for over 60 years. The highest yield was obtained from plot 8, viz., 37.1 bushels per acre; but in order to secure this result, a liberal dressing of nitrogenous phosphatic and potassic manures was applied each year. Continuous cropping has been practised at Roseworthy College (South Australia) on seven different plots in the permanent experimental field. The results are highly interesting, and indicate what is likely to take place in districts with a similar rainfall (17 inches).

"The plots which had been bare fallowed the previous year gave 11 bushels in the second year and 12 bushels in the third year, more than plots on which the wheat was grown continuously. Moreover, since the yields in the continuously cropped plots decreased from 29 bushels to 4 bushels in two years, it is obvious that these plots were rapidly reaching the condition known as 'worn out,' and would need a long period of rest before again giving a profitable return."

Rotation Systems for Wheat.—"The restoration of organic matter to the soil can be brought about by green manuring, as well as by the feeding down of forage crops. Green manuring, i.e., the ploughing in of green crops such as peas, rye, vetches, etc., is a much more effective method of restoring organic matter to depleted soils than the feeding down of forage crops. As, however, the feeding value of a green crop is usually greater than its manurial value, the general practice is to convert the crop into milk, mutton or beef, instead of ploughing it under. No system of crop rotation—however well conceived and carried out—can make up for any shortcomings in either cultivation or manuring. Crop rotation alone, without adequate manuring, will not increase nor even maintain the soil's fertility."

Stable Manure.—"The average wheat holding at the present time is so large, and the amount of stable manure produced in a year so small, that the effect of the stable manure on the fertility of the farm will, for all practical purposes, be inappreciable. This state of affairs will not, however, continue indefinitely. With the rapidly increasing population, and the inevitable increase in land values ahead of us, individual holdings must gradually become much smaller in size, and the system of farming more diversified. Live stock will become more and more prominent, and ultimately the amount of farmyard manure produced on the farm will be sufficient to have a distinct effect on the fertility of the farm. On the dairy farm, however, as contrasted with the wheat farm, farmyard manure is of great importance. Generally speaking, a good sample will contain about 13 lbs.

of nitrogen, 7 lbs. of phosphorus and 13 lbs. of potash per 2,000 lbs. Losses may be reduced to a minimum by (a) controlling the fermentation of the manure, and (b) by prevention of leaching. The fermentation may be controlled by keeping the manure heap well compacted, and keeping it moist. Losses by leaching may be avoided by building the manure heap on a raised cemented floor, with sloping sides. The liquid manure drains towards the side of the floor and collects in a pit, and is periodically pumped over the manure heap."

Green Manuring.—"The object of green manuring is to increase the organic content of the soil, which we have already seen is a dominating factor in soil fertility. There can be no doubt that many of the soils in the wheat-growing areas, which have been under cultivation for a comparatively long period, have lost a considerable amount of the organic matter they formerly contained. The turning-in of green crops is one of the most rapid methods of increasing the organic reserves in the soil.

"The important point to bear in mind is that crops which produce a maximum weight of green stuff that can be turned under in early spring, before the soil becomes too hard and dry to plough, should be grown rather than crops which give a relatively small yield of green stuff of high quality."

Value of Tobacco Seed Treatment in the Control of Wildfire and Blackfire.

By F. D. FROMME, Plant Pathologist, Va. Agr. Exp. Sta.

The tobacco season of 1921 in Virginia showed a great contrast to that of 1920 in the injury caused by the wildfire and blackfire diseases, there being only a small amount or none at all of these diseases in the majority of fields during the present season, while many crops were ruined in 1920. The great difference was due chiefly to weather conditions, which were unfavourable for the spread of the germs which cause these diseases. The treatment of tobacco seed, as advocated by the Department of Plant Pathology of the Virginia Agricultural Ex-

periment Station, naturally did not show striking results this year owing to the general absence of disease in the fields. Sufficient evidence was obtained, however, from the inspection of plant beds sown with treated and untreated seed to show that the treatment would have shown good results in most cases if the season had been favourable for the development of disease in the field. One of our tests shows in a convincing way that these diseases may be carried on the seed, and that seed treatment is effective. Sample lots of seed taken from seed sent to us by farmers for treatment were sown in small sections of a plant bed. Ninety such lots were used, a sample of each being taken both before and after treatment. Blackfire (angular-spot) developed in 23 different lots where untreated seed was used, while none whatever developed in any of the corresponding treated lots. These samples came from all parts of the State, and it may be concluded from this, that, of the seed used by farmers last year, about one lot of seed in four carried the blackfire disease. The test also indicates that seed treatment can be expected to eliminate, or at least greatly reduce, this source of danger.

Additional proof that blackfire is carried on tobacco seed or in the chaff and dirt mixed with the seed was obtained in another test in which a section of a plant bed was sprinkled with chaff cleaned out of tobacco seed. Blackfire developed on the plants in this section, but did not develop on the other sections of the bed on which no chaff was used. It does not seem likely that tobacco seed can be cleaned thoroughly enough in a blower to eliminate this source of danger, but cleaning alone undoubtedly will help to reduce it.

Our inspection of plant beds on farms has furnished additional proof, to that previously obtained, that there are other sources of infection in addition to the seed. The evidence shows that these diseases may be carried on old canvas, in soil and in manure, and that, consequently, seed treatment alone cannot be expected to provide adequate insurance against infection. For convenience we have separated the farmer's plant beds which we inspected into three groups: (1) those in which the seed was treated and the canvas was boiled; (2) those in which the seed was treated and the canvas was not boiled; (3) those in which the seed was not treated and the canvas was not boiled. The difference in amount of disease in these different groups was as follows: 71 per cent. of the beds in group (1) were free from disease or contained only a very slight amount, while 67 per cent. of those in group (2) and 82 per cent. of those in group (3) showed abundant infection. It was evident in several cases that the plant bed had become infected from nearby tobacco fields. These beds were located on the edge of a field of the previous season on which the suckers had been allowed to stand over winter. The disease was most abundant in the side of the bed nearest the fields. A few cases were also seen where the disease had lived over winter in the field and had infected the crop after it was transplanted. These cases also occurred where suckers were allowed to stand over winter. It seems that danger from this source will be greatly reduced if the suckers are turned under in the fall or early winter. The season's experience has also shown that if boiling of the canvas is attempted it must be done thoroughly. The boiling should be done.

in a vessel large enough to contain the canvas, and it should be continued for two or three hours. Evidence was also obtained to show that the disease may be carried to the plant bed in manure, and it seems evident that it is unsafe to apply manure in any form to the plant bed.

Of the two materials which we have used in the treatment of tobacco seed, formaldehyde and corrosive sublimate, the latter seems preferable. Neither causes any appreciable amount of injury to germination, *but the formaldehyde treatment often causes a delay in germination.* The corrosive sublimate solution should be used in the one to one thousand strength, and the seed should be soaked in this for 15 minutes. It is a deadly poison and must be handled with great care. The treating must be done in glass or wooden vessels.

To summarise:—The experience of the past season shows that the treatment of tobacco seed is of value in the control of blackfire and wildfire, but that it must be supplemented by the use of new canvas, or old canvas that has been thoroughly boiled. The treated seed should not be put back into a bag that has been used previously for tobacco seed nor stored in any place where it has a chance to become contaminated. The same precautions should be observed with the canvas after boiling. In addition, the plant bed should not be located near a tobacco field or bed of the previous season, and no manure should be used on it. The danger of carrying the disease over in the field where old land is used will be greatly reduced by fall ploughing.

[*Note.*—During August, September and October 325 pounds of tobacco seed were treated with formalin and distributed to tobacco growers by the Department of Agriculture, Salisbury. This amount represents the major portion of seed sown in Southern Rhodesia, and should largely decrease the percentage of tobacco damaged by wildfire and blackfire. In some cases farmers report that treated seed failed to germinate, but it is thought that germination was only retarded, and that many tobacco seed beds were re-sown before the seed originally used had been allowed time to come up. Germination tests of seed returned show this to be true in several instances. Some treated seed showed very poor germination, but this was no doubt due to the seed being of weak vitality. The attention of tobacco growers is particularly directed to that part of the above article relating to fall ploughing of tobacco lands. This practice, besides assisting in reducing damage to tobacco from "leaf spot," is desirable as an ordinary farm practice.—H. W. TAYLOR, Tobacco Expert.]

Green Manuring and Soil Management.

"Cultivator," in an appreciative review published in the local press upon an article which appeared in the last issue of this *Journal*, entitled "Green Manuring and Soil Management," by the Chief Chemist of the Agricultural Department, quoted the following statement from the article:—

"Green manuring does not add to the store of phosphoric oxide and potash in the soil, but the selection of an approved legume will enrich the soil not only in humus but also in nitrogen, which is extracted from the air by the micro-organisms living in the nodules on the roots."

"Cultivator" concludes from this statement that apparently it is only the nitrogen *in the roots* which benefits the soil, because he finds nothing in the article to show that any of the plant foods contained in the crop above ground level directly enrich the soil when ploughed in, a deduction which leads him to put to the author the following question:—"If the mineral plant foods contained in a crop when ploughed in are not added to the soil, what becomes of them?"

"Cultivator's" review has been referred to Mr. Blackshaw, who replies as follows:—

The answer to "Cultivator's" question is given in the following extracts from the article itself, thereby showing that his deduction is scarcely justified. The sentence immediately following that quoted from the article by "Cultivator" reads as follows:—

"It is estimated by some authorities that these micro-organisms absorb from the air two-thirds of the nitrogen present in the plant, and that, as about one-third of the nitrogen of a plant is present in the roots, the nitrogen contained in the plant above ground is an index of the amount of nitrogen absorbed by the plant from the air through the agency of these micro-organisms." (*Vide* page 459.)

Obviously this does not coincide with "Cultivator's" statement that nothing in the article shows that any of the plant foods contained in the crop above ground level directly enrich the soil when ploughed in.

Earlier in the article (on page 458) it is stated:—"Whilst deep-rooted green-manuring crops will bring within the range of more shallow-rooted crops some of the phosphoric oxide and potash present in the sub-soil, *inherent* deficiencies in phosphoric oxide and potash are not corrected at all by green manuring, consequently any lack of one or both of these constituents in the soil must be corrected by direct application of manures containing phosphates or potash as required."

Since the phosphoric oxide and potash contained in all plants are obtained from the soil, ploughing in a green crop does not *add* to the store of these plant foods in the soil, for the crop simply *returns* them to the soil.

Briefly stated, green manuring with an approved deep-rooted nodule-bearing legume enriches the soil in humus, which improves its physical condition and water-holding power, enriches the soil in nitrogen and raises plant food from the sub-soil to the feeding zone of more shallow-rooted crops. *Inherent* deficiencies in phosphoric oxide and potash are not corrected by green manuring, but the decomposition of a green crop turned into the soil promotes the "weathering" of the insoluble mineral plant foods in the soil, which renders them more available for the nourishment of plants. *Inherent* deficiencies in phosphoric oxide and potash in the soil must be corrected by the direct application of manure as required, and sourness by the direct application of lime.

In his review "Cultivator" puts a further question:—"Under a perfect system of mixed farming, including green manuring, would the use of artificial fertilisers still be necessary?"

To obtain the best results, the use of fertilisers would still be necessary. The extent and nature of the fertilisers required will depend upon the character of the soil, the amount of manure produced on the farm from purchased feeding stuffs and the crops grown. In other countries where mixed farming has been practised for generations, and a considerable quantity of purchased feeding stuffs are consumed on the farm, fertilisers are invariably used in addition to the large amount of farm manure produced annually.

The three constituents of plant food in which soils are liable to be deficient and with which the science of manuring is concerned, are nitrogen, phosphoric oxide and potash. So long as the supply of humus is preserved in arable land by green manuring with a nodule-bearing legume or by the application of farmyard manure, it is a reasonable assumption to make that the store of nitrogen in that land will not be depleted. It is, however, difficult to estimate the loss or gain of nitrogen to the soil, because, on the one hand, there are agencies at work whereby nitrogen is absorbed by the soil from the air, and, on the other, there is wastage of nitrogen due to loss by fermentation and by drainage.

Concerning the phosphoric oxide and potash, I cannot do better than quote from the "Book of Rothamsted Experiments," by Sir A. D. Hall:—

"When the mineral constituents of plant food are considered—the phosphoric oxide and potash—there is no difficulty in estimating the annual loss or gain to the soil, because we know that there are no recuperative agencies at work to increase the original stock of such mineral substances in the soil, nor, on the other hand, are the only possible losses, those by drainage, of any moment. The annual draft on the soil can then be estimated with accuracy if we know the amounts of the constituents in question which are contained in the manure supplied and in the crops removed."

If purchased feeding stuffs are used on the farm, the phosphoric oxide and potash contained in the manure produced therefrom will be a clear gain to the land, and deducting the amount of each contained in that manure at the time it is applied to the soil from the amount contained in the produce marketed, it is possible to obtain a fair estimate of the loss of these plant foods from the farm.

The practical farmer must, however, dismiss the theory that the proper manure or fertiliser is that which replaces what the crop removes from the soil, because it does not take into account the composition of the soil and the reserve of each constituent of plant food the soil contains. He must study the character of his land, ascertain by trials its specific requirements for each crop and adjust the manurial treatment accordingly.

Organisation of the Rhodesia Egg Output with a view to future Export.

TO EVERY KEEPER OF FOWLS IN RHODESIA.

By A. LITTLE, Poultry Expert.

In view of the very rapid increase in stock and eggs during the last six to twelve months and the number of farmers and others who have taken up poultry seriously, intending to make it infinitely more than a side line, and that those whose intention it is to do so are increasing daily, Rhodesia could now be self-supporting. The fowls of the country will do their duty if their owners will only give them a fair show. Many certainly do obtain the maximum output from their birds and use care in the collection, storing and marketing of the eggs, but there are still many who, due to lack of proper treatment, are not getting the most out of their birds. There is wastage between the nest and consumer due to carelessness in collecting, storing and

marketing and allowing eggs for market purposes to become fertile. Such wastage in the U.S.A. results in a loss yearly of £9,000,000 sterling; in this country it is also large; but most gratifying to note it is decreasing, and comparing the eggs produced in Rhodesia with those imported, the former are infinitely superior. The wastage in imported eggs is quite 90 per cent. due to their bad quality. Why should these eggs be coming into Rhodesia? We do not require them, and we certainly do not want such poor quality; however, such imports have been lessening for the past two years, and will soon be a thing of the past.

The imports of eggs for July and August, 1920 and 1921, were as follows:—

1920—July: 18,602 lbs. valued at £265. August: 9,899 lbs.
valued at £146.

1921—July: 2,429 lbs. valued at £225. August: 3,409 lbs.
valued at £289.

Many of those imported during the above months of this year were for hatching purposes, as will be seen from the difference in value.

These are two of the months in the year when eggs are scarcest in this country; therefore, it may be necessary to import at this period. We require none when eggs are plentiful, even though there is a wastage as noted above; without such wastage we should have a large surplus. It is evident that this surplus will have to be disposed of; the vital question, and it is a serious one, is to whom and in what way? The answer is obvious: primarily to the countries north of us, which have been and still are importing large quantities of eggs from the Union. *That* should be our market, and the sooner we get it the better. When these countries have a sufficient supply of eggs produced by themselves and imported from us our market will be overseas.

A further question is how is this to be brought about? Firstly and mainly by the co-operation, assistance and loyal support of the poultry keepers (both large and small) of the country who have been instrumental in helping to work up the output during the last three years. Very many who did not keep fowls are now doing so (if only a few for the production of eggs for household use), many for sale in small quantities and many for sale in large quantities; all help indirectly. I say indirectly advisedly, for the majority have done so for their own interests, to supply their own households and thus save buying, others to fill their own pockets and make a living, but to organise an export trade much more than these self-interests is necessary. Every poultry keeper can assist by his views on the matter, by his advice, by producing eggs *fit* for export (for only 2-oz. and over eggs of the best quality *must* be exported if we are to obtain a good export trade and keep it); by combining and forming egg societies in different districts, each affiliated to one central society working under expert control. To organise these is the work primarily of the poultry keepers of each district, especially the chairmen and executives of poultry clubs, prominent and influential poultry men and women, and possessors of large poultry plants. Once formed, each supplier of eggs *must* adhere loyally to the rules of the society.

Another alternative is a Rhodesian Poultry Keepers' Co-operative Society. Whatever scheme is inaugurated, it must be taken in hand immediately, and the Government Poultry Expert earnestly begs all who keep poultry to favour him with their views on the matter, and in those districts from whence such views are received he will arrange and address meetings. In order to ascertain the number of fowls in the country and eggs produced, he will be glad to receive statistics of such from every poultry keeper, however many or however few fowls he or she keeps. Naturally the number of eggs could only approximately be given in many cases, but as near as possible those sold and those used in the house and for hatching from 1st January to the present date should be stated.

It is a well known fact that organisation is essential to the fullest measure of success in any industry; this applies to no industry with greater force than to agriculture, and from this no section stands to gain more than that of the production of eggs. The industry of poultry keeping is carried on by those with a small number of fowls, those with a moderate number and those going in for it as the only source of income. The first two classes of poultry keepers are in the majority, and they must make use of the means most immediately available for the disposal of their produce. The quantities so produced do not admit of prompt and regular despatch in bulk nor for proper grading, therefore in the absence of organisation for collection and sale of eggs such producers must depend upon the local tradesmen, grocers, bakers, hotels, etc.; thus the best markets, especially for the best article, are denied them. The same applies to eggs placed on the local markets in small quantities. What we require as above alluded to are district egg circles or egg societies, followed by a federation of such societies with a central clearing house system for allocating supplies to consuming centres and export.

This question of organisation of the egg output and egg circles I have frequently alluded to and discussed since my advent to this country, but the majority of poultry keepers, while they are able to dispose of their eggs by yearly contracts or otherwise, continue in this old-fashioned way and show little interest in the matter, especially when eggs are fetching high prices, although some bring up the matter of egg circles when prices are low and only then. Now it behoves all to approach the matter in all seriousness. I intend to follow this by a series of short notes on organisation, egg circles, societies, storage of eggs, class of eggs for export, etc. Before doing so, however, I want the views of as many poultry keepers as possible, the names of those who are willing to give their support by supplying eggs, and statistics of the poultry and eggs of the country as a basis upon which to inaugurate this much-desired—in fact, most important and most necessary—organisation for the benefit of every poultry keeper, large and small, and the poultry industry of the country. Remember that without your assistance and loyal support I cannot do so!

Southern Rhodesia Egg-Laying Test Report.

Ninety-five birds were laying during the four weeks ended 10th November and produced 1,612 eggs, an average per laying bird of 16.96 eggs, or for the 99 on the test (one bird died on 20th October in pen 3 and has not been replaced), 16.28 eggs. There were 1,284 eggs each weighing 2 ozs. and over, and 328 each weighing under 2 ozs.

The total weight of eggs was 179 lbs. 4 ozs. (141 lbs. 1 oz. weight of eggs 2 ozs. and over, and 38 lbs. 2 ozs. weight of eggs under 2 ozs.).

The maximum number of eggs laid on one day was 70, on 19th October; the minimum was 44, on 6th November; the average number per day was 57.57.

Pen 13 laid 106 eggs during the four weeks.

Pen 15 laid 102 eggs during the four weeks.

Pens 9 and 11 laid 101 eggs during the four weeks.

Pen 12 laid 95 eggs during the four weeks.

Pen 17 laid 93 eggs during the four weeks.

Pens 1 and 16 laid 90 eggs during the four weeks.

Pen 8 laid 88 eggs during the four weeks.

Pen 19 laid 85 eggs during the four weeks.

Of the trap-nested birds the following laid—

25 eggs—Nos. 62, pen 13, and 83, pen 17.

24 eggs—Nos. 22, pen 5; 38, pen 8; 54 and 55, pen 11; 60, pen 12.

23 eggs—Nos. 61, pen 13, and 81, pen 17.

22 eggs—Nos. 5, pen 1; 36, pen 8; 41, pen 9; 51, pen 11, and 64 and 65, pen 13.

21 eggs—Nos. 4, pen 1; 27, pen 6; 35, pen 7; 42 and 44, pen 9; 58, pen 12; 71, 72 and 75, pen 15.

20 eggs—Nos. 30, pen 6; 45, pen 9; 56 and 57, pen 12, and 74, pen 15.

Broodiness.—Seventeen birds have been broody during the four weeks, 12 among the heavy breeds and 5 among the light breeds; 9 have been cured, 2 of which have started to lay again and 8 are still broody.

One bird in pen 3 is suffering from swollen joints and legs and swelling of the face and comb; this bird is being treated, but the improvement is slow and intermittent; cure is doubtful. One bird in pen 3 died on 20th October; cause of death, fatty degeneration of the kidneys and septicæmia. The remainder of the birds are in good health.

As will be noticed, the output of eggs is less than that of the previous period. This is probably due to (1) broodiness; (2) the

strain of heavy laying beginning to tell somewhat, especially as the weather has been very hot and dry; (3) laying in some pens was poor on the 21st, 22nd and 23rd (the good layers continued uninterruptedly). Rain fell on the 19th, 20th and 21st, together with slight hail. Although the birds did not become wet (being as they were confined to their houses), the change in weather affected the medium layers.

The average number of eggs laid per bird since the commencement of the test, a period of 32 weeks, is 122.58.

Below is a comparison of the average number of eggs laid per bird during the first 28 weeks in the tests at present running in South Africa:—

Southern Rhodesia	106.46	eggs per bird.
Potchefstroom School of Agriculture	106.25	„ „
Cedara School of Agriculture	89.05	„ „
Western Province' Agricultural Society, Rosebank	69.04	„ „

The eggs on this test are being sold at 3s. per dozen. A contract at this price was made for the duration of the test, but it must be remembered that they are all good quality eggs, none being more than three, at the most four, days old when they reach the consumer. I know a large breeder who is getting an all-the-year-round price of 3s. 3d. clear per dozen, and a number of farmers and breeders 2s. 9d. clear for similar quality eggs; but the medium or poor egg will not command this price. On this basis the 100 birds on the test have in 32 weeks produced eggs to the value of £153 4s. 6d.; and calculated on the same basis the value produced in 52 weeks would be £248 19s. 10d. on a flock of birds, many of which might be better layers, as are those in pens 9, 11, 12, 13 and 16.

The positions on the test are based on the total weight of 2-oz. and over eggs to educate and induce the poultry keepers of the country to aim at producing such eggs, which weight is necessary for export. Eggs on the London market were fetching in August 3s. to 3s. 3d., and in September on the provincial markets 3s. to 3s. 8d.

THE SECOND ANNUAL SOUTHERN RHODESIAN EGG-LAYING TEST.
FIVE BIRDS IN EACH PEN.
EIGHTH PERIOD (32 WEEKS).
HEAVY BREED SECTION.

1st April, 1921, to 2nd March, 1922.

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April to 10th November, inclusive.		
					Total No. of eggs.		Total weight of eggs.
					2 ozs. and over.	Under 2 ozs.	
1	6	R. Conlthard	Salisbury ...	White Wyandottes	365	283	49 lbs. 13 10-16 ozs.
2	4	Mrs. Brokensha	Umtali ...	do.	445	14	60 lbs. 4 2-16 ozs.
3	7	Mrs. Pocock	Artbennie ...	Bd. Plymouth Rocks	276	24	38 lbs. 13 10-16 ozs.
4	1	C. L. Brown	Salisbury ...	Rhode Island Reds	584	22	80 lbs. 13 10-16 ozs.
5	6	H. Tatham	Penhalonga ...	White Wyandottes	502	75	65 lbs. 14 4-16 ozs.
6	5	A. G. Walker	Salisbury ...	do.	399	61	50 lbs. 8 ozs.
7	3	A. T. Wagstaff	Pretoria ...	Black Orpingtons...	483	109	7 lbs. 10-16 ozs.
				Totals ...	3,054	588	403 lbs. 13 12-16 ozs.
							68 lbs. 4 8-16 ozs.
LIGHT BREED SECTION.							
8	12	E. O. B. Moe	Bulawayo ...	White Leghorns	453	224	58 lbs. 7-16 oz.
9	1	C. L. Brown	Salisbury ...	do.	673	35	87 lbs. 5 15-16 ozs.
10	9	Mrs. Redrup	Bulawayo ...	Black Leghorns	516	76	67 lbs. 8 1-16 ozs.
11	5	T. W. Brokensha...	Umtali ...	White Leghorns	648	162	83 lbs. 8 1-16 ozs.
12	4	B. S. Edgecumbe...	do.	do.	655	88	84 lbs. 3 ozs.
13	2	Weymouth Py. Farm	Bulawayo ...	do.	659	108	84 lbs. 14 ozs.
14	11	Yorkshire Py. Farm	do.	Anconas	460	89	61 lbs. 10 10-16 ozs.
15	10	Miss Greig...	do.	White Leghorns	484	94	62 lbs. 2 6-16 ozs.
16	6	E. C. Holmes	Bindura ...	do.	621	140	79 lbs. 8 3-16 ozs.
17	13	Avondale Py. Farm	Avondale ...	do.	293	315	35 lbs. 11 1-16 ozs.
18	8	Mrs. Redrup	Bulawayo ...	Anconas	533	58	68 lbs. 6 3-16 oz.
19	7	Mrs. Mulligan	Lobatsi ...	White Leghorns	561	42	76 lbs. 13 12-16 ozs.
20	3	Mrs. Hunter	P. B. Glendale	do.	614	15	84 lbs. 12 5-16 ozs.
				Totals ...	7,170	1,446	933 lbs. 15 13-16 ozs.
				Grand totals of both sections	10,224	2,034	1,237 lbs. 13 9-16 ozs.
							166 lbs. 7 5-16 ozs.
							234 lbs. 11 13-16 ozs.

Total number of eggs for 32 weeks, 12,258; total weight, 1,472 lbs. 9 6-16 ozs.
 There are 99 birds now on the Test. Positions are calculated on total weight of 2 oz. and over eggs.

Hints to Poultry Keepers.

By A. LITTLE, Poultry Expert.

Broodiness can be bred out. There are in existence strains of heavy breeds which are non-broody; a White Wyandotte breeder in U.S.A. has a big stock of White Wyandottes, none of which becomes broody. The method adopted to produce such birds is to breed year after year from only the best layers, which waste the least amount of time in this state. In these days of incubators it does not pay to allow good layers to become broody and sit; they can utilise their time more profitably by laying eggs for eating and to produce chicks. Even if the poultry keeper has no incubator and does not wish one, it pays better to buy birds for setting and keep his own good layers producing eggs.

Breed only from strong, vigorous, healthy birds with plenty of stamina, and so produce similar stock which will stand the strain of heavy laying the year through. Fowls should be treated as egg machines, and those to produce eggs for eating only should be kept at it continuously. Breeding birds should have a rest for a month or six weeks before the breeding season commences to recuperate and so produce strong chicks. Continuous laying can only be kept up by the strongest, and after a time their weaker and less vigorous sisters show signs of the strain and begin to lay either intermittently or stop altogether. The best layers too are not as a rule affected to nearly the same extent, as are the medium ones, by changes in the weather.

No poultry keeper should breed from a bird that is not a good layer, and only the very best of the good ones should be used for this purpose.

In a very short time, in fact within the next few months, Rhodesia should produce all the eggs required for her own consumption. The fowls of the country did their duty some time ago, and produced sufficient eggs for local consumption, but the wastage by their owners, due to carelessness in collecting, storing and packing, etc., discounted the output, and eggs, the majority of which to say the least leave much to be desired in quality, are still being imported, but in rapidly lessening quantities. We do not want such eggs in this country *and* we can do without them. The tide will now very shortly turn, and we shall have to export. Organisation to this end is about to be commenced, but every keeper of poultry must help. Firstly, by aiming to produce good quality eggs, for such only will be accepted; poor quality will be unsaleable. Secondly, by helping and being loyal to whatever egg circle, organisation or society he or she belongs.

Hartley District Tobacco Growers' Association.

We publish below the rules and constitution of the above association. We compliment the tobacco growers of the Hartley district upon their initiative in inaugurating such an association, which we feel sure will, if properly supported, be a power for good to its members, and also to the tobacco growing industry of the country. We are pleased to see that one of the objects of the association is to encourage farm or district grading. A number of growers last season graded their leaf, with good results, and it is essential that the warehouse in Salisbury should be relieved of much of this work, as the facilities and accommodation there are strictly limited. With the growth of the industry, it is probable that tobacco-growing districts will be required to grade their own leaf, for which purpose centrally situated warehouses will have to be built. It is well that the matter should be discussed.

With regard to Government classification, which is another of the objects of the association, this necessarily depends upon the attitude of those concerned in the industry. If the Government is asked to apply the terms of the Export of Produce Ordinance to tobacco, no doubt they will do so, but they have no wish to force Government classification upon the industry unless it would be acceptable to the producers.

RULES AND CONSTITUTION OF THE HARTLEY DISTRICT TOBACCO GROWERS' ASSOCIATION.

Article 1.—Name.

The association shall be known as the "Hartley District Tobacco Growers' Association."

Article 2.—Objects.

The objects of the association shall be to promote and foster the tobacco industry in all its branches. Among other ways in which this may be done are:—

- (1) to combine, meet and discuss matters of interest affecting the said industry; to take any action for the promotion of same;
- (2) to dispense and circulate among growers, by means of lectures, demonstrations and discussions, technical and practical knowledge which shall be of assistance to such in tobacco culture;
- (3) to encourage farm or district grading, and endeavour to obtain Government classification.

Article 3.—Membership.

Section 1.—Members of the association shall be confined to farm owners and managers engaged in tobacco growing.

Section 2.—The subscription to the association shall be five shillings (5/-) per annum, and no member in arrears with his or her subscription shall be entitled to any of the privileges of membership.

Section 3.—All subscriptions must be paid prior to the annual general meeting.

Section 4.—The mode of election of members of the association shall be by ballot; if called for, at any monthly or general meeting at which at least seven members must be present.

The names of all candidates for admission as members shall be lodged with the secretary and approved by the committee previous to the monthly or general meeting at which they are to be proposed; and such persons, whose names shall have been so lodged, as shall be approved of by four parts in five of the members balloting, shall be declared to be duly elected.

Section 5.—Each member on joining the association shall sign a form of membership and return it to the secretary.

Article 4.—Meetings.

Section 1.—The annual general meeting shall be held in Salisbury the day previous to the annual general meeting of the Rhodesia Tobacco Co-operative Society.

Section 2.—No rule or bye-law shall be altered unless special notice in writing be given to each member. Notices of motion by members of the association shall be lodged in writing with the secretary at least eight days before the meeting at which they wish their motion brought forward, and shall be stated in the circular calling such meeting.

Section 3.—Notice of motion may also be given immediately after the reading of the minutes, but it shall only be taken up provided three-fourths of the members present are in favour of it being brought forward. The proposer may make a brief statement, but the question of admission of such motion must be put without debate.

Section 4.—The secretary shall post to each member, not less than seven days before any meeting, a notice intimating when the said meeting is to take place, and, as far as possible, the subjects to be discussed.

Section 5.—The meetings of the association shall be held at Norton Store or at central points in the district by invitation.

Section 6.—The dates of meetings shall be decided by members at the previous meeting.

Section 7.—The secretary, upon receiving a requisition signed by not less than five members to call a special meeting, shall do so upon giving not less than seven days' notice, and stating the object for which such meeting is called.

Section 8.—The meetings of the executive committee shall be held at such times and places as the president may decide.

Article 5.—Officers.

Section 1.—The officers of the association shall consist of a president, two vice-presidents, secretary-treasurer and auditor. The executive committee shall consist of the president, two vice-presidents, secretary-treasurer and five other qualified members.

Section 2.—The association, when a ballot of ordinary members is to commence, after the names and designations of the candidates have been read over, shall have the power, by unanimous consent of the members present, to dispense with the form of individual ballot, provided it shall appear to the satisfaction of the meeting that the names of all the candidates on the list have been read and approved of in and by the meeting of the committee immediately preceding such general or other meetings, and in this case the election shall be deemed and held to have been made by ballot, according to the intent and meaning of the rules.

Section 3.—In the absence of the chairman or vice-chairman, a chairman shall be elected from those present. The chairman of any meeting shall have a deliberative and casting vote.

Section 4.—The secretary shall write minutes and proceedings and carry on the ordinary correspondence of the association. All records, papers, correspondence and accounts shall be subject to the inspection of any member.

Section 5.—All members desiring to speak at any meeting shall address the chairman, and shall do so standing. The ruling of the chairman on any point shall be respected as final.

Section 6.—In case of any vacancy occurring by resignation or otherwise of any office-bearer, such vacancy may be filled by a fresh election at any ordinary meeting.

Section 7.—The association may from time to time frame and adopt such bye-laws as may be considered necessary in the interests of the association.

Article 6.—Finance.

Section 1.—The financial year shall be reckoned from the first day of June to the thirty-first day of May in each year, and a detailed account of income and expenditure of the association shall be laid before the annual meeting over the signatures of the auditor and chairman.

Section 2.—The balance sheet, with all necessary data, must be submitted to the auditor a week previous to the annual general meeting.

Section 3.—Cheques for application of money must be signed by the secretary-treasurer of the association, and countersigned by the chairman or one of the vice-chairmen.

Article 7.—Resignations.

No resignation of a member will be accepted or considered valid unless sent to the secretary in writing.

Article 8.

All persons interested in growing of tobacco will be welcomed at the general meetings of the association, but only members shall be able to vote.

Review.

SOUTH AFRICAN IRRIGATION DEPARTMENT MAGAZINE.

A new publication bearing the above title has recently made its appearance. It is issued quarterly under the ægis of the Irrigation Department of the Union Government, and additional copies can be obtained by sending one shilling and threepence to the Statistical Clerk, Irrigation Department, Union Buildings, Pretoria. This first number contains numerous notes on matters of interest to the irrigator, as well as a good deal of information concerning the various schemes, projected or under construction, in the Union. Amongst the schemes in hand we note the following:—

Hartebeestpoort Dam, for the irrigation of approximately 30,000 acres.

Lake Mentz Dam.

Kamanassie Dam, for the irrigation of 12,000 acres.

Grassridge Dam, for the irrigation of 8,000 acres.

Tarka Dam, for the irrigation of 5,000 acres.

Van Ryneveld's Dam, for the irrigation of 16,000 acres.

Tygerpoort Dam.

Bon Accord Dam, for the irrigation of 2,750 acres.

It is evident that our neighbours in the south are beginning to realise the enormous value of irrigation in the development and settlement of South Africa, and we hope at no very distant date to see more schemes of this nature taken in hand here. Irrigation spells closer settlement, and there are many very promising schemes in this country which could be carried out at low cost and afford the means of creating dozens of small farms where only one exists to-day.

The S.A. Irrigation Department Magazine has made a very promising start, and we wish it every success.

Southern Rhodesia Veterinary Report.

August, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality was reported:—Nyamandhlovu, 14; Bubi, Belingwe, 8; Umzingwane, 52; Insiza, 11; Plumtree, 2; Matobo, 71; Bulawayo, 9; Victoria, 69; Melsetter, 21; Umtali, 50; Inyanga, 23; Gwelo, 8; Charter, 9; Makoni, 3; Salisbury, 4; Lomagundi, 12; Marandellas, 5.

CONTAGIOUS ABORTION OF CATTLE.

Fresh centres of infection reported from several districts.

TRYPANOSOMIASIS.

Five head of cattle affected in Wankie district.

SCREW WORM (MYIASIS) OF CATTLE.

Twenty cases reported in the Bulalima-Mangwe district, two in Bubi and a few in Gwanda.

HORSE-SICKNESS.

The following mortality was reported:—Bulalima-Mangwe, 2; Belingwe, 1; Charter, 3; Umvuma, 1; Victoria, 3.

MEALIE FUNGUS POISONING.

In the Gwelo and Gutu districts a number of cattle died as the result of eating mealie stalks and cobs infected with "dry rot," *diplodia Zea*.

TETANUS.

Tetanus is so rarely seen amongst the domestic animals in Southern Rhodesia that the occurrence of three cases in calves, following castration, is worthy of record.

IMPORTATIONS.

From Union of South Africa:—Bulls, 40; heifers, 27; horses, 140; mules, 57; donkeys, 58; sheep, 1,760; goats, 260.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 1,286; breeding, 102; trek oxen, 100; bulls, 3; horses, 2; pigs, 20. To Congo:—Goats, 120; sheep, 120; pigs, 65. To Northern Rhodesia:—Pigs, 3; sheep, 65. To Portuguese East Africa:—Horse, 1; mules, 5; bulls, 4; trek oxen, 75; slaughter oxen, 97; cows, 11; calf, 1; pigs, 10.

September, 1921.

AFRICAN COAST FEVER.

No cases occurred during the month.

QUARTER-EVIL.

The following mortality was reported:—Melsetter, 7; Marandellas, 5; Mtoko, 2; Salisbury, 1; Umtali, Makoni and Inyanga, 20; Gwelo, 25; Selukwe, 8; Charter, 4; Plumtree, 9; Matobo, 50; Bulawayo, 5; Inyati, 1; Insiza, 8; Belingwe, 26; Umzingwane, 1; Gwanda, 58.

SCREW WORM (MYIASIS) OF CATTLE.

Ten cases reported in Bulalima-Mangwe district and two in Gwanda district.

CONTAGIOUS ABORTION OF CATTLE.

Fresh outbreaks occurred in the Victoria, Marandellas and Bulawayo districts.

HORSE-SICKNESS.

One horse died at Urungwe and one at Darwin.

DISEASE OF PIGS.

Twenty pigs died on a farm in Marandellas district, but the cause has not yet been determined.

IMPORTATIONS.

From Union of South Africa:—Bulls, 190; heifers, 110; horses, 48; mules, 31; donkeys, 172; pigs, 39; goats, 509; sheep, 1,794.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 966; breeding cattle (via Liebig's Drift), 453; pigs, 55. To Congo:—Bull, 1; cows, 8; pigs, 60. To Northern Rhodesia:—Sheep, 50. To Portuguese East Africa:—Horse, 1; slaughter oxen, 201; trek oxen, 104; cows, 40; bulls, 2; pigs, 50; goats, 2.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Agricultural Outlook.

The season so far has been exceptionally favourable, as the rainfall has been sufficient in practically every district to enable ploughing to be undertaken, while nowhere have the rains been so persistent or so excessive as to hinder agricultural operations. Advantage should be taken of an early season to get the land into good condition rather than to make use of it for unduly early sowings. More is to be gained by getting the land into good tilth than by getting the seed into the ground a few weeks earlier than usual.

Maize is likely to be our staple crop for many years, and from what can be gathered there will be little or no decrease in the acreage planted to maize this season. It was hoped in this issue to publish the usual annual statistics of crops grown during the past season, but these are not yet available, and will appear in our February issue. The winter wheat crop has been a good one, and yields on irrigated land of from eight to ten bags per acre are spoken of in the Victoria district. Wheat is now one of our principal crops, and many farmers are investigating their water sources and the possibilities of their vlei lands with a view to the growing of wheat. The movement to which we referred in the last issue of the *Journal* has developed into the formation of the Rhodesian Wheat Growers, Ltd., which has now completed arrangements for the disposal of members' grain.

Tobacco growers are starting to plant out, and from all indications there will be an increase in the acreage under the crop this season. It

is hoped growers will take precautions to reduce the percentage of low grade tobacco, for which the demand is decreasing. If the proportion of inferior leaf next season is as great as it was last year there will probably be a difficulty in finding a market for it; tobacco of good quality will, however, sell readily at a remunerative price.

The rains have brought on the young grass, and the veld is rapidly changing to a verdant green. Weeds also are springing up, amongst them being Mexican marigold, which is much in evidence on new lands. This weed is becoming a serious menace and a determined effort must be made to keep it in check. The only effective way of dealing with it is by pulling it out by the roots before it seeds. With the arrival of green grass cattle are improving in condition and seem to have wintered well, though the prevalence of grass fires has caused some distress. Disease appears to be well in hand, and with the exception of contagious abortion, there is little to report. Stock owners will be pleased to note from an editorial notice in this issue that vaccine is now procurable from the Veterinary Department at a reasonable charge.

The prospects of rapid development of the dairy industry are bright. The price paid for butterfat at local creameries is almost 50 per cent. above the pre-war figure. Overseas prices are reasonably firm. A large consignment of butter manufactured in the Union and recently exported has been most favourably commented upon in the London market, and sold at 180s. per cwt. There is no danger of over-production for the present. The English market has been deprived of about 80,000 tons of butter imported, before the war, from Siberia and Russia. In pre-war times Great Britain imported 220,000 tons of butter, of which only 60,000 tons came from the Dominions overseas. Farmers are therefore advised to develop the dairy industry to its utmost. This can only be done by taking greater care of the dairy stock, and by the provision of winter feed, as it is during the winter that dairying is most profitable. It is, however, obvious that, besides the provision of winter feed, it is absolutely necessary to give the dairy cows some shelter where they can be fed in comfort. A farm cow stable need not necessarily be either expensive or elaborate, so long as a water-tight roof and manger are provided. Dairy cows, of all farm animals, give the greatest monetary return for food supplied, and farmers in the present state of the meat market would be well advised to pay particular attention to the income-earning dairy cow.

Farming Calendar.

December.

BEE-KEEPING.

Honey in good quantities will still be coming in, as the welcome rains will be beneficial to veld blooms. Continue to give room by extracting honey from shallow frames, then return these to be refilled. Extracted honey should be drawn from the machine into the honey ripener, into which it should be strained through several thicknesses of butter muslin, remaining there, to allow surplus water to evaporate, for five days, then draw off from the tap into clear white glass bottles. All bottles must be cleansed thoroughly. See that ventilation is ample on hot days.

CITRUS FRUITS.

Citrus trees can be planted out at any time between October and the end of January. The best time is the end of October or early November, when the ground is warm and trees have hardened up their first growth of season, i.e., spring growth, and are in fit condition to commence second growth, which they will do if transplanted properly at that time—end of October. Citrus trees should not be planted later than the end of January, as the growth they put on after planting later than this is very liable to be still sappy at the approach of winter, and consequently more sensible to the effect of cold. The young trees require to be well watered after planting. The soil around them should never be allowed to be really dry, but, on the other hand, it must not be kept in a state of sogginess. Immediately after planting protect the stems of the young trees from the sun by whitewashing or covering up with grass. Cut the tree down so as to leave a stem of about 2 ft. 6 ins. or 3 ft. long, and form the head of the future tree in the top 8 ins. or 1 ft., according to the best position of the shoots, not more than three or four in number. All other growths to be suppressed whenever they appear. Keep the soil nice and loose by digging, forking or hoeing round the young trees. It will then not be necessary to water them so frequently. The orchard should by this time have been thoroughly ploughed, and any cover crop sown already be up and growing. Don't forget, before the wet season, the first ploughing should be up and down the steepest gradient of the orchard, and be followed immediately after harrowing by cross-ploughing across the hill. This is to obviate as much as possible erosion of the soil during the coming heavy rains. Remember that, if a long spell of dry weather occurs during the so-called wet season, your bearing orange trees will probably require an application of water, otherwise the crop of fruit may receive a check from which it will never properly recover.

CROPS.

This is the busiest planting month of the farm year, during which most crops should be sown. Main crop maize planting is usually commenced in November and continued through December, but should be finished if possible at latest by Christmas. Light harrowing with the Hallick weeder or light tooth harrow soon after germination of the maize and until the plants are 6 to 10 inches high is beneficial, most in keeping down weeds and maintaining a soil mulch. This harrowing is better done during the heat of the

day, when plants are less liable to break off. Other crops which will be sown during the month are ground nuts, velvet beans, sunflower, cowpeas, pumpkins, mangold, majorda melons, linseed, hibiscus and Sunn hemp for fibre or seed.

DAIRYING.

The summer now being far advanced, attention should be given to the percentage of fat in cream, as the cream should contain a higher percentage in the summer than in the winter. Adjust the cream screw of your separator so that you obtain cream testing from 40 to 50 per cent. butter fat. The reason for this is that a heavy bodied cream carries better than one testing only 30 per cent., and will remain sweeter during a long journey. Most separators are adjusted to skim cream testing about 45 per cent. butter fat, and if an excessively high testing cream is produced the efficiency of the separator will be impaired and a loss will be sustained in the separated milk. So do not attempt to separate cream of a higher test than 50 per cent. Cheese making is now in full swing, and it should be remembered that good cheese cannot be made from tainted or acid milk. Clean milk is essential for cheese making, and it can only be obtained by the provision of a milking shed with an impervious floor. Milking in a muddy kraal will result in a gassy bitter cheese being produced. During the wet months the provision of a dry, warm shelter for calves is essential. Exposure to inclement conditions of weather and retention of the calves in a filthy, muddy kraal will result most probably in an epidemic of white scour and ophthalmia. Commonsense treatment and commonsense housing are necessary if dairy calves are to be successfully reared.

During this month provision for winter feed should be made by sowing maize for silage, pumpkins, sweet potatoes, cattle radish, mangels, sunflowers both for seed and silage, ground nuts, teff grass, Boer manna, Sudan grass, beans and cowpeas.

ENTOMOLOGICAL.

Maize.—Plant during first half of this month to avoid stalk borers. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Distribute poisoned bait shortly before or immediately after planting on red soils to destroy various pests, including surface beetles, snout beetles, etc., which may affect the stand. See "Maize on Red Soils," *Agricultural Journal*, April, 1919. Cutworms and Maize Beetle (*Heteronychus*) may be in evidence. See "Cutworms," *Agricultural Journal*, August, 1918, and the "Maize Beetle," *Agricultural Journal*, February, 1918.

Tobacco.—The newly planted crop is subject to the attack of cutworms, surface beetles, stem borers, leaf miners, "wireworms," grasshoppers, large crickets, etc. A good deal of protection may be obtained by dipping the tops of the transplants as far as the roots in arsenate of lead 1 lb. to 15 gallons of water. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds may be injurious to the foliage. See "Two Ladybirds injurious to Potato Plants," *Agricultural Journal*, October, 1915. On sandy soils blue blister beetles may be troublesome. An immediate spraying with arsenate of lead 1 lb. to 12 gallons water should give relief.

Cabbage, Turnip, etc.—Webworm and diamond back moths are still the main pests. See "Cabbage Webworm," *Agricultural Journal*, February, 1914. Dusting with Paris green and lime should give protection against both pests.

Bean.—Stem maggot may be serious in December, especially if previous crops have been grown for French beans in gardens. See "Bean Stem Maggot," *Agricultural Journal*, April, 1913.

Melon, Marrow, etc.—Leaf-eating beetles frequently destroy the very small plants entirely. Spray with an arsenical and sugar wash or dust with Paris green 1 lb., lime 20 lbs.

Deciduous Trees.—Chafer beetles, fruit beetles are commonly very troublesome. See "Chafer Beetles," *Agricultural Journal*, December, 1914.

Fig.—Collect and destroy all fruit infested with fig weevil, and any wild figs near to the orchard.

Mosquitoes, House Flies, Stable Flies.—Destroy all breeding places round homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

FORESTRY.

Give the ground the final harrowing, and if the season is a normal one, planting out should commence. This is the ideal month for planting out in a normal season, as the young trees have the benefit of all the summer rains, and become well established before the dry winter months arrive. Plant on dull, rainy days, or failing such days, late in the afternoons.

POULTRY.

Many of the early hatched birds should now be laying while the older hens are moulting. Don't on any account move the birds to new quarters after they have commenced to lay nor suddenly change their food or general treatment; if this is done, they will stop laying and go into a partial moult.

The birds that are moulting should be given additional food of an oily nature such as linseed, monkey nuts, more green food, especially cabbage, kale, etc., also a little flowers of sulphur to assist the growth of feathers. If this is carefully carried out, they will lay and moult simultaneously, for the food they previously used to produce eggs is now used to produce feathers, therefore additional food must be given.

During the rains the poultry keeper must, if he wishes his birds to continue laying well, see to it that they are not allowed to get wet during the day or night, that their house is water-tight and that the floor of it is quite dry. This is the chief cause of the scarcity of eggs during the rains; it is, however, useless to confine them to a house if they are not kept busy scratching, by having small or cracked grain buried in deep litter. It is during the rains that we have a large number of dirty eggs coming on to the market. This should not be; utmost care should be used to keep the eggs as clean as in dry weather, by clean nests and preventing the birds having access to wet and muddy ground. The time is not far distant when the cleanest, freshest and best eggs will fetch the highest prices, and stale, dirty eggs will have no sale at all.

Any bird that becomes broody at this time of the year, or in fact till next February or March, is useless while she is so, and unprofitable immediately she becomes so. She should be placed in the broody coop and checked; certainly not allowed to occupy the nest and so prevent those laying having access to it and be the cause of broken eggs.

The pens and runs during this and next month should be turned over, and a quick-growing crop such as rape, oats, barley, etc., grown in them; it supplies green food for the birds and is the best method of purifying the ground, infinitely better than using lime or a similar disinfectant.

Young turkeys must be kept absolutely dry both during the day and night, otherwise the mortality will be very great. No turkeys should be hatched after September at the latest, but hatching should re-commence directly the rains have ceased. Ducklings can be hatched all the year round, but during the hot weather they *must* be kept out of the sun, and they *must* also have a perfectly dry place to sleep in, covered with a good layer of dry grass, which should be renewed every three or four days.

STOCK.

Cattle.—The veld in most districts is now good, and little trouble in respect of grazing is likely to be experienced. Ranching cattle should not require any attention beyond dipping, but any stock that are in weak condition will be the better for a little hay or a pound or two of maize at night until they have regained strength. The bulls should be returned to the herd either at the end of the month or in January, and it should be remembered that the better they are conditioned and fitted for their work the more hope there is of a good crop of calves. For this reason also every effort should be made to have all the female stock in strong condition. Dairymen will find that as the grass becomes lush and rank a supply of sweet veld hay, teff hay or, say, three pounds of crushed maize given in the sheds at night will enhance both the quality and quantity of the milk. This will be found to be the case more particularly in districts of heavy rainfall. Milch cows should be protected as much as possible from cold rains and hot sun. Yarding all night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather. Dipping should be regularly attended to.

Sheep.—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks.

TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on freshly prepared soil. Transplanting should be pushed as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertilisers to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

VETERINARY.

Occasional cases of horsesickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gallsickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

WEATHER.

In Mashonaland usually six inches of rain fall this month, and in Matabeleland five inches, but considerable variations occur. Less rain usually falls at this time in extreme southern parts of the country. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight or may extend to six weeks; in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe, to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

January.

BEE-KEEPING.

Where it is desirous, artificial swarms can now be made, so also can nuclei be formed from proved best working strains. All the above must be stimulated with food. In the cooler districts it will be necessary to contract the entrances and close down for winter.

CITRUS FRUITS.

(See under December notes.)

CROPS.

Sowing of maize and beans for ensilage and Sunn hemp or beans for green manuring may be continued up to the middle of the month. Hay crops such as teff grass, manna, Sudan grass and summer oats should go in during the first week of this month. Napier fodder, Kikuyu and other grasses may be planted out, and catch crops of teff and buckwheat can be put in up to the end of the month.

DAIRYING.

(See December.)

ENTOMOLOGICAL.

Maize.—This crop is subject to the attack of stalk borer, maize beetle (*Heteronychnus*), snout beetles, grasshoppers, crickets, etc. See *Agricultural Journal*, April, 1919. Maize planted after the first of the year is extremely liable to almost complete failure as a crop from the second brood of the stalk borer. See *Agricultural Journal*, December, 1917. This is of less importance in regard to ensilage.

Tobacco.—Most of the pests of this crop are active during January, e.g., stem borer, leaf miner, "wireworms," surface beetles, large crickets, grasshoppers, etc. See *Agricultural Journal*, December, 1919, February, 1920.

Potato.—Certain ladybirds are apt to defoliate the young potato plants of the main crop, especially on farms where early potatoes are also grown. See *Agricultural Journal*, October, 1913. Blue blister beetles are apt to be injurious on sandy soils, and may be checked by spraying with arsenate of lead 1 lb. to 12 gallons of water. Spraying should be commenced for early blight. See *Agricultural Journal*, August, 1913.

Cabbage Family.—Plants of this family are subject to the attacks of webworm and sawfly in January. See *Agricultural Journal*, February, 1914, April, 1910, April, 1917, June, 1918.

Beans and Cowpeas.—These suffer chiefly from stem maggot. See *Agricultural Journal*, April, 1913. On small plots aphid may be checked by spraying with tobacco wash or paraffin emulsion.

Melon Family.—The chief pests in January are leaf-eating beetles. Spray with an arsenical wash or cover young plants.

Citrus Trees.—The fruit is subject to the attack of citrus codling. Collect and destroy the infested fruits. For this and other citrus pests see *Agricultural Journal*, February, 1916.

Deciduous Fruits.—These are all subject to the attack of fruit-eating beetles. See "Chafer Beetles," *Agricultural Journal*, December, 1914. Fruit moths are injurious during this month, the only preventive measure being to net the trees. For fruit fly remedies, see *Agricultural Journal*, August, 1911.

Fig.—The adult beetles of the fig borer are to be found on the young shoots. They should be destroyed. The grubs in the stems may be killed with a little carbon di-sulphide.

Mosquitoes, House Flies, Stable Flies.—See under previous month.

FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or failing that, on a dull day, or late in the afternoons.

POULTRY.

No young cockerels should be running with the pullets and hens. By this time *all*, except those retained for breeding and selling for breeding (which must be kept away from the hens and pullets), should have been disposed of for killing. This is a point on which very many poultry keepers go wrong; the result is loss of cash due to a lessened output, for the hens and pullets are more contented when running without a male bird and lay better. Further, fertile eggs, if not collected in the hot weather as soon as laid or if not properly stored, soon become bad. The loss per annum from this cause and bad packing, etc., in the United States of America is nine million pounds sterling, and it is regrettable to note that the loss also in this country is very great. Further, young cockerels which run with the pullets and hens cannot possibly develop into the strong, vigorous birds that are necessary to produce strong, vigorous stock; yet we frequently see cockerels, cocks, pullets and hens running together. Many of the pullets are now laying; these as they show signs of doing so, if on free range, should be confined to the house and run till they have laid a few eggs and become accustomed to the nests. Then let them out on free range again, otherwise they will lay in the bush and continue to do so, and the eggs are lost, and much time and money are wasted searching for and collecting these. No birds should be allowed to steal their nests; if comfortable, clean ones, placed in the quietest and darkest corner of the house, are provided, they will seldom do so.

It is usually during the rains that any weakness in the birds shows itself; such birds should be noted by the owners, marked with a leg band or other method, and never used for breeding from. If the weakness is very noticeable the best method is to use them for the table. Far too many birds lack vigour and stamina, or having had an illness and been cured, are bred from, and these serious faults are transmitted from generation to generation, causing waste of time and trouble, and loss of money to their owner. Breed from *no* bird but what is strong, healthy and vigorous.

Those intending to commence poultry keeping should now start to get things ready. The house and run, or houses and runs, coops, utensils, etc., should all be erected and made by the end of this month, and the first batch of chicks hatched at the end of March, or at the latest the first week of April. Hatching should continue as rapidly as possible to the (at the latest) middle or end of September. Too many seem to think they can

hatch all the year round; this *can* be done, but there is no profit attached to it.

The breeding stock should be mated up not later than the end of the second week in February. Commence to keep the eggs for hatching on the 22nd to 24th of the same month, and put the first eggs into the incubator under the hens on the 5th to 7th of March.

STOCK.

Cattle.—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

Sheep.—Continue as recommended for December. If heavy rains are experienced a daily ration of half a pound of maize per ewe will keep them in condition and will often prevent much trouble arising from poverty and anaemia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating. A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attack. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth so that the plants ripen as uniform as possible. Curing barns should be placed in proper condition on rainy days and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform plants for producing seed for next season's crop.

VEGETABLE GARDEN.

Turnips, carrots, cabbage, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

VETERINARY.

Horsesickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, seven-and-a-half in the north, and less as one travels westwards or southwards. At this time of year the rainfall tends to be heavier in the eastern than in the western portion of the Territory, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.

Weather Bureau.

The mean barometric pressure during the month of September was below normal in Mashonaland and above normal in Matabeleland. During October the pressure was normal in Matabeleland, but still below normal in Mashonaland. The temperature during September was over 2 deg. below normal over the whole country, whilst the October temperatures were normal. The method of grouping the rainfall stations has been somewhat changed in this issue and will require some explanation. The country has been divided into six rainfall zones, the boundaries of which are determined by the divides between the main drainage areas of the country and not wholly by district boundaries. Some districts, therefore, appear in two zones, dependent upon the location of the stations in the district.

Zone A includes all stations in the north-western drainage area to the Zambesi (Western Matabeleland).

Zone B includes all stations in the south-eastern drainage area to the Limpopo (Eastern Matabeleland).

Zone C includes all stations in the northern drainage area to the Zambesi (Western Mashonaland).

Zone D includes all stations in the north-eastern drainage area to the Mazoe and Ruenya Rivers (North-eastern Mashonaland).

Zone E includes all stations in the southern drainage area to the Sabi (South-eastern Mashonaland).

Zone F includes all stations on the eastern slopes of Inyanga, Umtali and Melsetter (Eastern Border).

In addition a fourth column has been inserted showing the normal rainfall for each station to the end of the period under review. This will furnish a means of comparison between this season's rainfall and the normal distribution.

In the western portion of Matabeleland (*Zone A*) the October rainfall was $\frac{1}{2}$ to $\frac{3}{4}$ inch above the normal except in Bulalima, Wankie and Gwelo districts, where there was a slight deficiency. In the whole of the eastern portion of Matabeleland (*Zone B*) the October rainfall was $\frac{1}{4}$ to $\frac{1}{2}$ inch below the normal.

In the whole of the western portion of Mashonaland (*Zone C*) the rainfall to the end of October was $\frac{1}{4}$ to $\frac{1}{2}$ inch above the normal.

In the north-eastern portion of Mashonaland (*Zone D*) the rainfall to the end of October was $\frac{1}{2}$ to 1 inch below normal except in Inyanga district, where it was more than 1 inch above normal.

In the south-eastern portion of Mashonaland (*Zone E*) the rainfall to end of October was $\frac{1}{2}$ to 1 inch below normal with the exception of

Makoni, Marandellas, Melsetter and Umtali districts, where it was 1 to 2 inches above normal.

Along the eastern border (Zone F) the rainfall was 3 inches above normal to the end of October.

RAINFALL.

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE A. :				
Bubi—				
Imbesu Kraal ...	...	2.14	2.14	1.13
Inyati ...	...	1.93	1.93	1.12
Bulalima—				
Kalaka ...	...	1.07	1.07	1.22
Riverbank ...	...	1.01	1.01	1.09
Bulawayo—				
Fairview Farm ...	...	0.78	0.78	1.10
Keendale ...	...	2.07	2.07	0.98
Lower Rangemore ...	...	1.98	1.98	1.11
Observatory ...	...	0.71	0.71	1.13
Paddy's Valley ...	...	2.96	2.96	1.10
Gwelo—				
Riverdale ...	...	0.65	0.65	1.03
Somerset Estate ...	...	1.12	1.12	0.91
Wankie—				
Waterford ...	...	0.71	0.71	0.90
Sebungwe—				
Gokwe ...	...	1.11	1.11	0.97
ZONE B. :				
Belingwe—				
Bickwell	...	0.74	0.74	1.00
Bubje Ranch ...	...	0.39	0.71	0.94
Bulalima—				
Garth ...	...	0.51	0.51	1.20
Retreat ...	...	0.49	0.49	0.98
Tjankwa (Syringa) ...	...	0.70	0.70	1.12
Tjomanie ...	...	1.77	1.77	1.13
Gwanda—				
Gwanda Gaol ...	...	0.06	0.57	0.96
Mtshabezi Mission ...	...	0.03	0.31	1.06
Tuli ...	...	0.06	0.39	1.01
Insiza—				
Albany ...	...	1.03	1.03	0.98
Filabusi ...	...	0.26	0.26	1.00
Fort Rixon ...	...	0.56	0.56	1.02
Infiningwe ...	...	0.05	0.29	1.18
Inyezi ...	...	0.31	0.31	1.00
Matobo—				
Holly's Hope ...	...	0.03	0.50	1.05
Rhodes Matopo Park ...	...	0.57	0.57	1.09
Umzingwane—				
Essexvale ...	...	1.12	1.12	1.13

RAINFALL—(Continued).

STATION	1921.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
E. C. :				
Barter—				
Bushy Park	...	2.18	2.18	1.35
Enkeldoorn	...	1.94	1.99	1.49
Marshbrook	...	2.68	2.76	1.50
Range	...	1.21	1.24	1.59
Umniati	...	1.62	1.62	1.19
Vrede	...	0.42	0.57	1.47
Wilimanzi—				
Wylde Grove	...	0.48	0.61	1.32
Welo—				
Cross Roads	...	1.97	1.97	0.94
Globe and Phoenix Mine	...	0.43	0.69	1.07
Rhodesdale Ranch	...	1.54	1.54	0.97
Woodenhove	...	0.87	0.87	1.07
Gwelo (Gaol)	...	0.16	0.16	0.97
Wartley—				
Ardgowan	0.05	2.43	2.48	1.58
Beatrice... ..	...	3.07	3.07	1.50
Carnock	0.08	1.68	1.76	1.60
Philippaugh	0.01	1.30	1.31	1.70
Cromdale	...	1.62	1.62	1.50
Elvington	...	2.09	2.09	1.60
Gatooma	0.12	1.21	1.33	1.60
Gowerlands	...	1.38	1.62	1.54
Hallingbury	0.43	1.68	2.11	1.44
Hartley Gaol	...	2.30	2.30	1.65
Jenkinstown	...	1.58	1.58	1.52
Nyagordi	...	1.89	1.89	1.50
Ranwick	...	1.16	1.16	1.44
Spitzkop	...	0.51	0.65	1.47
Womagundi—				
Argyle	0.25	1.60	1.85	1.69
Darwendale	1.20	0.83	2.03	1.59
Gambuli	0.04	2.12	2.16	1.93
Lone Cow Estate	...	3.18	3.18	1.73
Maningwa	...	1.41	1.47	1.81
Mrindagomo	0.14	1.82	2.33	1.92
Mukwe River Ranch	...	1.70	1.70	1.60
Palm Tree Farm	0.73	1.67	2.40	1.66
Sinoia	1.55	1.59	3.28	1.60
Sipolilo	...	0.07	0.07	1.61
Talfourd	0.04	1.60	1.04	1.76
Salisbury—				
Avondale	...	1.71	1.84	1.64
Botanical Experiment Station... ..	...	2.33	2.41	1.70
Bromley	...	3.55	3.55	1.75
Cleveland Dam	0.24	2.41	2.82	1.57
Gwebi	0.10	1.34	1.47	1.75
Hillside	0.03	2.36	2.56	1.61
Lilfordia	0.48	1.22	1.70	1.54
Salisbury Gaol	...	1.30	1.30	1.63

RAINFALL (*Continued*).

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE C.—(Continued)				
Salisbury—continued				
Sebastopol	...	1.86	1.94	1.9
Stapleford	...	0.02	1.25	1.36
Tisbury	...	0.04	1.71	2.10
Vainona	...	0.05	1.21	1.36
ZONE D. :				
Darwin—				
Mount Darwin	...	0.98	0.98	1.9
Inyanga—				
Inyanga	...	1.78	...	1.9
Rhodes Estate	...	2.87	3.18	1.9
Makoni—				
Eagle's Nest	...	1.37	1.48	1.9
Wensleydale	...	1.27	1.27	1.9
Mazoe—				
Benridge	...	0.98	0.98	1.9
Bindura	...	0.53	0.53	1.9
Ceres	...	1.27	1.27	1.9
Citrus Estate	...	2.38	2.41	1.9
Craigengower	...	1.95	1.95	1.9
Kilmer	...	2.10	2.10	1.9
Kingston	...	1.53	1.53	1.9
Mazoe	...	0.05	2.78	2.83
Mazoe Dam (centre)	...	1.96	1.99	1.9
Omeath	...	1.08	1.12	1.9
Ruia	...	0.35	0.35	2.0
Ruoko Ranch	...	0.79	0.79	1.9
Rustington	...	1.08	1.08	1.9
Shamva	...	0.86	0.86	1.9
Stanley Kop	...	2.17	2.17	1.9
Sunnyside	...	1.18	1.18	1.9
Teign	...	1.26	1.26	1.9
Virginia	...	1.22	1.22	1.9
Zombi	...	1.46	1.46	1.9
Mrewa—				
Glen Somerset	...	1.55	1.55	1.9
Mrewa	...	1.17	1.17	1.9
Selous Nek	...	1.79	1.79	1.9
Mtoko—				
Makaha	...	0.25	0.25	1.9
Mtoko	...	1.10	1.10	1.9
Salisbury—				
Glenara	...	2.14	2.14	1.9
Goromonzi	...	1.78	2.09	1.9
Borrowdale	...	2.70	2.75	1.9
Meadows	...	2.67	2.78	2.0
ZONE E. :				
Charter—				
Buhera	...	0.45	1.05	1.9
Chilimanzi—				
Chilimanzi	...	1.62	1.62	1.9

RAINFALL—(Continued).

STATION.		1921.		Total to end of period.	Normal rainfall to end of period.
		Sept.	Oct.		
ZONE E.—(Continued)					
Chilimanzi—continued					
Driefontein	...	...	0.48	0.54	1.39
Felixburg	...	...	0.93	0.93	1.35
Grootfontein	...	...	0.49	0.49	1.41
Induna Farm	...	...	0.33	0.36	1.49
Gutu—					
Gutu	...	...	0.31	0.31	1.54
M'vimvi Ranch	...	0.07	1.67	2.29	1.47
Tel-el-Kebir	...	...	0.48	0.76	1.51
Gwelo—					
Ballock	...	0.02	0.14	0.16	1.10
Lovers' Walk	...	...	1.13	1.13	0.94
Oaklands	...	0.07	0.13	0.23	1.14
Partridge Farm	...	0.15	0.29	0.44	1.15
Sheep Run Farm	...	...	1.35	1.35	1.05
Belingwe—					
Belingwe	...	...	0.52	0.52	1.27
Insiza—					
Thornville	...	...	1.15	1.15	1.24
Inyanga—					
St. Trias' Hill	...	0.09	1.06	1.15	2.05
Makoni—					
Chimbi Source (Chitora)	...	...	2.28	2.53	1.80
Craigendorau	...	0.02	1.99	2.42	1.58
Forest Hill	...	...	2.67	2.91	2.10
Gorubi Springs	...	...	0.72	0.96	1.94
Mona	...	...	2.58	2.77	1.78
Monte Cassino	...	...	5.84	5.93	1.80
Rusape	...	...	2.96	2.96	1.50
Springs	...	...	2.16	2.16	1.90
Marandellas—					
Bonongwe	...	...	3.30	3.30	1.59
Delta	...	...	2.31	2.33	1.86
Land Settlement	...	...	1.79	1.82	1.68
Lendy Estates	...	...	3.82	3.82	1.85
Marandellas	...	...	3.10	3.10	1.88
Nelson	...	...	2.11	2.23	1.56
Melsetter—					
Brackenbury	...	0.17	0.93	3.09	2.66
Melsetter	...	0.23	1.15	3.58	2.36
Tom's Hope	...	0.28	2.23	4.28	2.40
Ndanga—					
Bikita	...	1.12	1.32	3.20	3.13
Doornfontein	...	...	1.01	1.01	1.45
Ndanga	...	0.45	1.20	1.65	2.21
Triangle Ranch	...	...	0.47	0.47	1.30
Selukwe—					
Hillingdon	...	0.06	0.67	0.73	1.61
Rio	...	0.02	0.45	0.47	1.49

RAINFALL (*Continued*).

STATION.	1921.		Total to end of period.	Normal rainfall to end of period.
	Sept.	Oct.		
ZONE E.—(Continued)				
Umtali—				
Gilmerton	0·44	0·13	0·78	1·60
Jerain	...	0·36	0·95	1·66
Mutambara Mission	0·19	4·30	4·49	1·50
Odzani Power Station	0·09	1·59	3·20	1·84
Premier Estate	0·05	1·10	1·43	1·52
Stapleford	0·60	3·43	7·63	3·26
Umtali (Gaol)	...	0·52	1·04	1·63
Victoria—				
Cavan	...	0·24	0·24	1·42
Clipsham	...	0·59	0·67	1·49
Gokomere	0·04	0·67	0·77	1·34
Histönhurst	...	0·77	0·77	1·40
Makahori Farm	...	0·58	0·58	1·35
Makorsi River Ranch	0·21	0·46	0·67	1·72
Morgenster Mission	0·08	1·02	1·34	2·09
Riverdene North	0·06	0·70	0·85	1·35
Silver Oaks	...	0·44	0·60	1·47
Stanmore	0·01	1·40	1·56	1·45
Summerton	...	0·52	0·52	1·30
Tichidza	0·40	1·66	2·37	1·81
Victoria	...	0·75	0·85	1·35
ZONE F.:				
Melsetter—				
Chikore	0·50	2·82	4·08	2·43
Chipinga	0·26	4·56	7·42	2·47
Helvetia	0·69	6·69	11·66	3·10
Mount Selinda	0·64	5·19	8·58	3·51
Vermont	0·48	6·43	11·45	3·38
Umtali—				
Hoboken	0·38	1·35	4·05	3·02

means nil.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1921-22		
			December	January	February
Banket Junction ..	Banket Hotel	Hon. J. S. Parker	3	14	4
Bindura ..	Bindura	G. Ashew	10	5	11
Bromley ..	Farmers' Hall, Beatrice	C. R. Deary	29	20	25
Charter-Ngezi ..	Arcadia Farm and Mt. Darwin Store alternately	W. Krienke	1		
Darwin ..	Farmers' Hall, Beatrice	J. W. Giles	11	8	12
Eastern Border (South Melsetter)	Farmers' Hall, Beatrice	J. W. Giles	10	13	10
Entenriase ..	Good Hope School	J. Watson	16	14	11
Feilixburg-Gutu ..	Arcturus Hotel	J. Watson	17	4	11
Feilixburg—Gutu ..	Noekdale Farm and Feilixburg	W. K. Hudson	10	14	11
Figtree Branch, R. L. and F.A.	Figtree Hotel	A. S. Will	25	22	22
Gabza ..	Hunyani Drift	A. Kelsey-Harvey	15	14	16
Gatooma ..	Gatooma	E. Steele	No	fixed	dates
GreyStone ..	Chapungu	M. Wood	No	fixed	dates
Gwanda ..	Royal farm houses, Shangani	M. Wood	No	fixed	dates
Gwanda ..	Royal Hotel, Gwanda	A. C. Edmonstone	17	21	18
Hartley ..	Hartley	J. de L. Nimmo	24	28	25
Headlands ..	Headlands	J. Grewar	1		
Hunter's Road Farmers and Stockowners	Hunter's Road Siding	R. W. Twilley	10	14	11
Inisza—Shangani ..	Hanganani	R. W. Twilley	17	14	11
Inyanga ..	Headlands	R. L. Weale	17	14	11
Inyanga ..	Inyanga	P. H. Bolus	20	17	21
Lalapansi ..	Lalapansi	R. E. Courthope	19	16	20
Lomagundi ..	Sinona	J. G. Clarkson	10		
Macheke ..	Macheke	W. L. McLean	No	fixed	dates
Makwiro ..	Makwiro	D. M. Syme	16	25	22
Matopos ..	Matopos	R. W. Twilley	18	29	26
Matopos ..	Russell's Farm, Makoni South	W. B. Tuckey	16	14	11
Marandellas, Northern ..	Marandellas Farmers' Hall	A. V. Stanley	3	7	4
Marandellas, Southern ..	Various Farms	F. N. Gibson	7	1	1
Mashonaland ..	Commercial Hotel, Salisbury	Robertson	1	5	2
Matopo Branch, R. L. and F.A.	Various farm houses	S. Gillespie	1	fixed	dates
Mazoe ..	Glendale	M. B. Dudley	14	11	8
Mazoe Central ..	Glendale	J. B. Tuckey	9	13	10
Melsetter (North) ..	Melsetter	J. Hartley	14		
Melsetter (North) ..	Cronley	R. Wodehouse	14		
Midlands Farmers and Stockowners	Royal Hotel, Gwelo	M. Danziger	13	10	14
Norton and District ..	Norton Store	W. Wrench	4	7	4
Nyanandlovu ..	Nyanandlovu	Geo. Graham	No	fixed	dates
Que Que ..	Que Que	J. Ross	17	21	18
Rhodesian Landowners and Farmers	Various Buildings, Bulawayo	E. S. Douglas	20	23	23
Selukwe ..	Various farms	A. L. Douglas	17	20	23
Selukwe ..	Selukwe	E. E. Somerset	No	fixed	dates
Shamwa ..	Shamwa	A. Musson	15	19	16
Various ranches ..	Various ranches	S. P. Light	17		
Umtali ..	Royal Hotel, Umtali	J. S. Holland	1	5	2
Umtali, Northern ..	Farm Summerfield	A. Muloch	No	fixed	dates
Vuvuma District ..	Vuvuma	M. W. Graham	21	28	25
Western ..	Western	Major A. J. Dunn	3	6	3
Western ..	Plumtree Hotel	W. R. Boucher	10	14	11

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 170. Production of Pedigree Seed—Maize, by H. Godfrey Mundy, F.L.S.
- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 176. The Cultivation of Castor Oil Beans, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 207. Crop Rotation in Southern Rhodesia, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 252. Cultural Notes on Buckwheat, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 293. Some Useful Crops for Granite Veld Farms, by R. C. Simmons.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
400. Soil Washing, by A. C. Jennings, Assoc. Mem. Inst. C.E.
403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

94. Second Report on Experiments, by J. H. Hampton.
189. The Manuring of Maize on the Government Experiment Farm. Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.

TOBACCO.

132. Sumatra Tobacco, Hints to Rhodesian Growers, by C. J. Sketchley
144. Rhodesian Tobacco—Prospects of an Australian Market, by Eric A. Nobbs, Ph.D., B.Sc.
326. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
333. Tobacco Culture—Field Operations, by H. W. Taylor, B.Agr.
339. Tobacco Culture; Harvesting and Curing, by H. W. Taylor, B.Agr.
346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
347. Tobacco Pests of Rhodesia, by R. W. Jack, F.E.S.
373. Turkish Tobacco, by H. W. Taylor, B.Agr.
398. Wildfire and Angular Spot.
404. Flue-Curing Tobacco Barns and Packing House (Second Revision), by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.
231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.

- No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
- No. 208. Water in the Diet of Live Stock, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
- No. 255. Pound Fees.
- No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
- No. 288. Stock Records for Ranches in Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 292. Branding and Drafting Pens, by R. C. Simmons.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 331. Theory and Practice of Feeding Cattle in Southern Rhodesia, Part I., by R. C. Simmons.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 243. Shedding for Milch Cows, by R. C. Simmons.
- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.

- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 95. Oestrus-ovis in Sheep, by Alec King.
- No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 202. Distomatosis or Liver Fluke in Cattle and Sheep, by Rowland Williams, M.R.C.V.S.
- No. 289. Contagious Abortion in Cattle, by Sir Arnold Theiler, K.C.M.G.
- No. 312. Anthrax, by C. R. Edmonds, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
- No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
- No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
Redwater Treatment and Gall Sickness.

IRRIGATION.

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- No. 206. Hints on Irrigation : Small Earthen Storage Reservoirs, by W. M. Watt.
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etc.
- Directory of Rhodesian Farmers and Ranchers.
- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 470 of 1921.]

[30th September, 1921.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 214 of 1921, declaring the farms Nyaroro, Wari and Mangamba, in the native district of Lomagundi, an area infected with swine fever.

No. 471 of 1921.]

[30th September, 1921.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

HIS Honour the Administrator has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to approve of the following regulations for the due or better carrying out of the object and purposes of the said Ordinance:—

1. When an animal has died or is suspected of having died of anthrax, the owner or person in charge of the carcass shall cause it to be completely burned, or, if burning is impossible, shall cause it to be buried intact and the burial place enclosed in such a way as to prevent stock from grazing over it.

2. The person in charge of an animal suffering from anthrax shall cause all excreta, litter and discharge whatsoever therefrom to be buried or burned and the place where such discharges have lain to be properly disinfected.

3. It shall be the duty of the owner or person in charge of an animal which has been in contact with an animal affected with anthrax to cause or permit such animal to be vaccinated as may be directed by the Controller of Stock, Chief Inspector, Inspector or Sub-Inspector.

4. When an animal has died or is suspected of having died of quarter-evil (symptomatic anthrax or sponsziekte) the owner or person in charge of the carcass shall cause it to be buried intact at a depth of not less than three feet from the surface of the ground.

5. The penalty for a contravention of these regulations is a fine not exceeding twenty pounds, or in default of payment, imprisonment with or without hard labour for a period not exceeding three months.

No. 521 of 1921.]

[28th October, 1921.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 111 of 1921, declaring the farms Clearwater and Northfield, in the Gwelo native district, an area of infection.

No. 522 of 1921.]

[28th October, 1921.

"THE POUNDS AND TRESPASSES ORDINANCE, 1903."

IT is hereby notified that His Honour the Administrator has been pleased, under section 5 of "The Pounds and Trespases Ordinance, 1903," at the request of the Civil Commissioner, Gwelo, to abolish the pound on Hillview Farm, established under Government Notice No. 182 of 1916, and to establish a pound on Lalapanzi Farm, Gwelo native district, and that the said pound is now available for the public.

No. 555 of 1921.]

[11th November, 1921.

"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 469 of 1921, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard areas in lieu thereof :—

MELSETTER NATIVE DISTRICT.**(a) *Area of Infection.***

The farms Glencoe, Hayfield, Mermaid's Grotto, Rumble Rills, Tarka, Springfield, Tilbury, Dunstan and Welgelegen.

MELSETTER AND UMTALI NATIVE DISTRICTS.**(a) *Area of Infection.***

The farm Quagga's Hoek.

(b) *Guard Area.*

The farms Kronstad, Lombard's Rust, Ostend, Thaba Nchu, Penkrige, McAndrews, that portion of the Mutambara Reserve lying east of the old road from Umtali to Melsetter, Ruwaka, Bulls' Run and Pieter's Hoek.

No. 491 of 1921.]

[7th October, 1921.

"IMPORTATION OF PLANTS REGULATION ORDINANCE, 1904."

IT is hereby notified that His Honour the Administrator has been pleased, under and by virtue of the powers conferred upon him by the "Importation of Plants Regulation Ordinance, 1904," to prohibit, from and after the date of this notice, the introduction into Southern Rhodesia from any place overseas of grain of maize and barley, except under the authority of a permit, the granting of which shall be at the discretion of the Director of Agriculture, who may attach such conditions to the importation as he may deem desirable.

Any person guilty of a contravention of the provisions of this regulation, or of any of the conditions imposed upon any permit granted in terms thereof, shall be liable to a fine not exceeding £10.

No. 476.]

[30th September, 1921.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water:—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection.
Martha Lamb ...	Eskbank ...	Salisbury ...	Unnamed tributary of the Mazoe River, rising on farm Eskbank	To store and divert public and storm water	To irrigate 45 acres	Three months
James Dakers Lamb	Oldbury ...	Salisbury ...	Three unnamed tributaries of the Mazoe River rising on farm Oldbury	To store and divert public and storm water	To irrigate 72 acres	Three months
John William Dunlop	Patterson ...	Mazoe ...	Dassura ...	To store and divert public and storm water	To irrigate 10 acres of land	Three months from 11/11/21

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

No. 561.]

[18th November, 1921.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection
J. A. Tapson	Dyffryn	...	Makoni	...	...	...
D. Black	Maryvale	...	Mazoe	...	...	...
D. Black	do.	...	do.	...	...	...
A. C. Henderson	Great B.	...	do.	...	...	...
A. C. Henderson	do.	...	do.	...	...	...
A. C. Henderson	do.	...	do.	...	...	...
The Riversdale Estates Syndicate, Limited	Sub-divisions 14a and 15a of Belford Estate North	...	do.	...	...	...
P. Zaffere	St. Gerera	...	do.	...	...	...

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 480 of 1920, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections (if any) to the granting of these applications, together with a full statement of the grounds for such objections.

RHODESIA Agricultural Journal.

ISSUED BY

The Department of Agriculture,
SALISBURY, RHODESIA.

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The right of approval of all advertisements by the Director of Agriculture is reserved, and his decision as to the acceptance or rejection is final.

An additional charge may be made for advertisements printed in special type, equal to any additional charges made by the printers for setting up same.

Advertisements will be accepted from *bona fide* farmers wishing to effect sale, purchase or exchange of produce, live stock or farm implements, at a minimum charge of 2/6 per insertion of 20 words. Extra words will be charged for at the rate of 1/- for every 10 words.

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